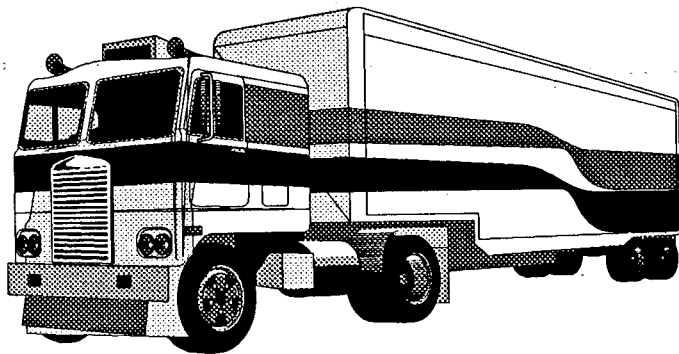




U.S. Department  
of Transportation  
**Federal Highway  
Administration**



# **Inspections of Interstate Commercial Vehicles 1992**

## **Office of Motor Carriers**



Publication No. FHWA/MC-95/012

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# **Inspections of Interstate Commercial Vehicles 1992**

**Publication No. FHWA/MC-95/012**

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**Prepared for**

**Office of Motor Carriers  
Federal Highway Administration  
U.S. Department of Transportation  
Washington, D.C. 20590**

**March 1995**



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## HIGHLIGHTS OF THE 1992 REPORT

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### 1992 OVERVIEW

- 1.5 million driver-vehicle safety inspections were conducted on *interstate* commercial motor carriers in Calendar Year 1992. (Inspections on vehicles operated by *intrastate* carriers are not reflected in these statistics.)
- 3.75 million violations—and 0.9 million out-of-service violations—were detected during the year.
- Three in 4 inspections contained violations of the *Federal Motor Carrier Safety Regulations*, *Hazardous Materials Regulations*, or comparable State codes.
- One in 3 inspections ended with the vehicle or driver being placed out-of-service.
- On average, 259 violations—and 61 out-of-service violations—were detected per 100 inspections.
- Three in 4 violations involved safety defects in the vehicle.
- Defects in brakes, lighting, and tires accounted for 50 percent of all violations.
- Ninety-eight percent of all inspections were performed using one of three methodologies: Level I (Full Inspections)—58 percent; Level II (Walk-Around Inspec-

tions)—30 percent; Level III (Driver-Only Inspections)—10 percent.

- For the five-year period, 1987-92, interstate inspection activity increased 219 percent, while the number of violations detected increased 244 percent.
- From 1987-92, the mean number of violations detected per 100 inspections increased from 240 to 259; out-of-service violation rates went from 59 to 61.

### CARRIER AND VEHICLE ATTRIBUTES

- Four in 5 inspections in 1992 were attributable to "known" carriers.
- Of the 116,000 known carriers, 40 percent were inspected 100 or more times each during the year, and 17 percent had over 500 inspections apiece.
- Known carriers were inspected, on average, 10 times each during the year.
- Three-fourths of inspections where carrier type was discernible involved for-hire carriers.
- One-half of inspections where fleet size was known involved carriers operating 38 power units or less.

- Smaller carriers had consistently higher violation rates than did larger carriers. For example, carriers operating fewer than 12 vehicles experienced, on average, 284 violations per 100 inspections; carriers with over 5,000 vehicles had, on average, 163 violations.
- Nine in 10 inspections involved tractor-trailers, mostly singles.
- As the number of units comprising an inspected vehicle increased, *vehicle* violation rates went up slightly: singles—207 violations per 100 inspections, doubles—215, triples—221. As the number of units increased, however, *driver* violation rates declined significantly: singles—56, doubles—41, triples—29.
- Buses were represented in 0.8 percent of all inspections, but experienced just 0.4 percent of all violations. Buses had the lowest violation rate of any vehicle group—whereas the violation rate for all vehicle types was 259 per 100 inspections, the rate for buses was 119.
- One in 10 inspected vehicles was transporting hazardous materials at the time of the inspection; on average, 46 hazardous materials violations were detected per 100 hazardous materials inspections. The overall vehicle-and-driver violation rate for inspections where hazardous materials were present was lower (204 violations per 100 inspections) than the rate for inspections where hazardous materials were not present (265).

## THE INSPECTION ENVIRONMENT

- Most States participated in the 1992 national inspection program.
- Inspections were variously conducted at *fixed* and *mobile* facilities.
- Inspections at fixed facilities tended to result in higher *vehicle* violation rates, while inspections at mobile facilities had slightly higher *driver* and *hazardous materials* violation rates.
- More inspections were performed in warmer weather than colder weather—45 percent more inspections occurred in Summer than Winter. Warmer-weather inspections tended to result in higher violation rates.
- Eighty percent of all inspections were conducted between 6AM and 6PM, with the heaviest concentration of activities occurring before noon.
- Daytime inspections produced 20 percent higher violation rates than did nighttime inspections.
- The average inspection was 31 minutes in length.
- Longer inspections resulted in the citation of more violations.
- Level I (Full Inspections), of all the inspection methodologies, produced the highest violation rates per hour of inspection activity.

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## INTRODUCTION

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This document presents aggregate statistics derived from the *1992 Interstate Motor Carrier Inspection Database*. The database was compiled from the records of driver-vehicle inspections conducted during Calendar Year 1992 by State and Federal officials responsible for commercial motor vehicle safety. The database is maintained by the Office of Motor Carriers (OMC), Federal Highway Administration, U.S. Department of Transportation.

This publication is intended to be used by individuals and organizations desiring general information on the safety fitness of interstate commercial carriers, as measured by driver-vehicle inspections conducted under the auspices of the *Motor Carrier Safety Assistance Program* (49 U.S.C. 350 and 355). Readers seeking general information will usually find that the materials in this document satisfy their basic data needs. Persons requiring more specialized information should contact the OMC directly.

### Scope of the Report

In 1992, State and Federal officials conducted 1,699,060 inspections of commercial vehicles engaged in interstate or intrastate commerce. This report, however, covers only those inspections of vehicles of carriers engaged in *interstate* commerce. "Interstate carriers" are defined to include (1) carriers who sometimes or always operate in inter-

state or foreign commerce, and (2) carriers of hazardous materials who operate in interstate, intrastate, or foreign commerce. A total of 1,449,226 inspections—or 85 percent of all inspections performed during the year—were determined to involve interstate carriers.

This report is limited to those data elements collected during driver-vehicle inspections and furnished to the OMC. Many States collected additional information, beyond what was mandated by the OMC, and used the data to satisfy specialized State requirements; these specialized data elements were never furnished to the OMC. Thus, this document reports only those essential data elements commonly collected by all participants in the national inspection program.

This report provides a general overview of 1992 inspection activity, including aggregate summaries of inspection outcomes, identification of major defects identified during the inspection process, and the examination of key variables which appear to influence inspection outcomes. The report *does not* contain information about specific trucking firms, and it *does not* include information, such as the identification of individual drivers, protected by data privacy rules.

Nearly all 1992 inspections were conducted by State personnel. However, 1,731 inspections—or 0.12 percent of total interstate

inspections completed during the year—were performed by Federal staff. This document reports the results of interstate inspections conducted both by State and Federal officials.

## Driver-Vehicle Inspections of Interstate Carriers

The Federally-funded *Motor Carrier Safety Assistance Program* (MCSAP) provides grants to States, the District of Columbia, and U.S. Territories for the conduct of commercial vehicle safety enforcement activities. In 1992, all States and Territories participated in MCSAP during all or part of the year except for Florida, South Dakota, Northern Marianas, and the Virgin Islands. The principal agency responsible for commercial vehicle safety varied from State to State, but typically included one of the following: the State Police or Highway Patrol, State Department of Transportation, or State Public Utilities Commission.

Driver-vehicle inspections are the primary enforcement activities performed under MCSAP. Inspections are conducted in accordance with standards developed by the Commercial Vehicle Safety Alliance (CVSA) in cooperation with the OMC. These standards establish national uniform inspection procedures and criteria for identifying violations of the *Federal Motor Carrier Safety Regulations* (49 CFR 382, 383, 387, and 390-399) and the *Hazardous Materials Regulations* (49 CFR 170-177). The standards include specification of out-of-service (OOS) violations, which preclude operation of a commercial vehicle by its driver (1) for a prescribed period of time, or (2) until specific vehicle defects are corrected or other conditions met.

Five different types of inspections are con-

ducted under MCSAP. The five types are:

- **Level I: North American Standard (NAS) Inspection.** The most comprehensive and thorough of the inspection types, it also normally takes the longest to administer. This inspection technique involves extensive vehicle checks—including under-the-vehicle measurement of brake performance—and examination of hours-of-service logs. In this report, Level I inspections are referred to as *Full Inspections*.
- **Level II: Walk-Around Driver-Vehicle Inspection.** Follows most procedures of the NAS inspection, except those actions which can only be accomplished by climbing underneath the vehicle (e.g., to measure brake performance). In this report, Level II inspections are referred to as *Walk-Around Inspections*.
- **Level III: Driver-Only Inspection.** Examines only the driver-related aspects of the NAS inspection, including compliance with commercial drivers' licensing (CDL) requirements, medical certifications and waivers, and the hours-of-service regulations. In this report, Level III inspections are referred to as *Driver-Only Inspections*.
- **Level IV: Special Inspection.** Ad hoc examination of particular items, usually inspected in support of a particular study or verification/refutation of a specific trend. Unlike Inspection Levels I-III, this level does not normally connote a distinctive inspection methodology per se—in practice, the methodology employed tends to vary from one special study to the next. Consequently, few analytic conclusions can be made about the data at this level since the inspection technique is not

consistent across the category. In this report, Level IV inspections are referred to as *Special Studies*.

- **Level V: Terminal Inspection.** Examination of vehicles at carriers' terminal facilities. Although the inspection methodology employed may vary, a walk-around vehicle inspection (similar to the Level II technique without the "driver" component) is generally used. Terminal Inspections normally focus only on the "vehicle" aspects of the inspection process. In this report, Level V inspections are referred to as *Terminal Inspections*.

Most inspections are conducted at permanent State Commercial Vehicle Weigh-In Facilities. But inspections are also performed at other locations, including mobile inspection sites, carrier terminals, and parking lots.

## Data-Processing

In 1992, nearly all inspection results were recorded on hardcopy State inspection reports. The reports were then forwarded to central State locations where they were entered into the SAFETYNET database. SAFETYNET is a State-based information system supporting the collection, processing, and analysis of commercial carrier safety data. Edit checks in SAFETYNET were used to ensure the general accuracy and consistency of inputs. Following completion of all edit procedures, and preliminary determination of carriers' State and USDOT Numbers, all inspection records pertaining to interstate carriers were uploaded to the OMC mainframe computer in Washington, D.C. (The USDOT Number is a unique carrier identifier used to keep track of inspection and other safety records associated with a given carrier.)

On the mainframe, additional edit checks were performed, final determinations of USDOT Numbers were completed, and the inspection records were loaded into the 1992 *Interstate Motor Carrier Inspection Database*.

To compile this annual report, USDOT Numbers in the Inspection Database were used to establish links to the *Motor Carrier Census Database*, which contains general descriptive information (fleet size, annual miles travelled, etc.) for each of the commercial carriers regulated by the OMC. These links, of course, could not be created for inspection records to which USDOT Numbers were not appended, and thus not all records in the 1992 inspection database could be associated with specific carriers. However, where counts of inspections and inspection outcomes were not specific to any carrier, all records were included—regardless of whether the records contained USDOT Numbers.

## General Approach

This report provides *snapshots* of 1992 inspection activity. It chronicles key patterns and trends in the 1992 data and, when appropriate, engages in rudimentary data analysis. The report is written for a broad audience, including readers not necessarily schooled in the technical subject matter. Consequently, the report vociferously avoids the use of most formal statistical terms and techniques.

Data in the report are presented as succinctly as possible. When only raw numbers or percentages are shown, effort is made to provide enough information so that readers with specialized needs can calculate some of the data not provided.

Major concepts employed in this report include the following:

- Raw *counts* of inspection activity are displayed at every turn. This is the report's primary "quantitative" measure.
- Inspection *outcomes* are calculated and compared in the form of *violation rates*, i.e., the number of violations detected per 100 vehicle inspections. Distinctions are drawn between *general violation rates*, which are calculated for all violations identified, and *OOS violation rates*, which are calculated on those violations resulting in vehicles or drivers being placed out-of-service. "Violation rates" is one of the report's primary "qualitative" measures.
- An index, called the *violation-to-OOS violation ratio*, is used to assess the *severity* of violations. The ratio gauges the proportion of violations which resulted in the issuance of out-of-service citations. Lower ratios usually mean that more severe violations were identified. The "violation-to-OOS violation ratio" is another of the report's "qualitative" measures.
- Violations are broken down into specific defect categories: *vehicles*, *drivers*, and *hazardous materials*. In this report, defects pertaining to the physical truck are always credited to the "vehicle"; defects pertaining to the operator are always credited to the "driver"; and defects involving hazardous materials are always attributed to the "hazardous materials" category.
- Five specific defects are used throughout the report to illustrate violation patterns generally. The five defects are: *brakes*, *lighting*, *hours-of-service*, *improper placarding*, and *improper shipping papers*.

Two of the defects pertain to the vehicle, one is a driver defect, and two are hazardous materials defects. The five specific defects were selected because they represent the most prevalent violations within each of the defect categories.

These concepts are examined in greater detail in the body of the report.

## Organization of the Document

This report moves from a *general* discussion of inspection activities and outcomes, to a more detailed assessment of the *internal* (carrier and vehicle) factors which influence inspection outcomes, and concludes with an examination of the *external* (environmental) factors which affect these outcomes.

The topics are explored in three chapters, as follows:

- **Chapter 1: 1992 Overview**
- **Chapter 2: The Impact of Carrier and Vehicle Attributes**
- **Chapter 3: The Impact of the Inspection Environment**

Within each chapter, data are organized under specific topics. A glossary of terms and a depiction of common vehicle configurations are presented in the Appendix.

## Data Conventions

The following conventions are used throughout this document:

- Percentages shown in tables and figures are rounded to the nearest one-tenth or one-hundredth of one percent, as appro-

priate. Percentages do not always total "100" due to rounding.

- Items in inspection records which were left blank, or which were too varied to group into meaningful categories, are noted in tables and figures under categories labelled "Other", "Unidentified", etc.
- When the size of the sample from which data in a given figure were drawn is not readily apparent, the sample size is identified at the base of the figure. For example, "N=1,449,226" means that the data shown were drawn from 1,449,226 inspection records.

### **Additional Information**

For responses to questions not addressed in this publication, please contact the Federal Highway Administration, Office of Motor Carriers, HIA-10, 400 Seventh Street, S.W., Washington, D.C. 20590. The telephone number is 202-366-4023.



# CHAPTER 1

## 1992 OVERVIEW

### Inspection Totals Violation Counts Summary of Defects Five-Year Trends

Nearly 1.5 million driver-vehicle inspections were conducted on interstate motor carriers in Calendar Year 1992. Three in four inspections contained violations, and one in three inspections involved one or more out-of-service violations. Collectively, the inspections resulted in the detection of 3.75 million violations, and nearly 900,000 out-of-service violations; this equates to an average rate of 259 violations—and 61 out-of-service violations—per 100 inspections. Three in four violations detected during inspections involved vehicle defects—indeed, brake, lighting, and tire violations together accounted for 50 percent of all violations. From 1987-92, interstate carrier inspection activity increased by more than 200 percent. Over the five-year period, the mean number of violations detected per 100 inspections increased from 240 to 259; out-of-service violation rates increased from 59 to 61.

### INSPECTION TOTALS


The 1,449,226 inspections of interstate vehicles and drivers conducted in 1992 may be divided into four classes:

- *Inspections/No Violations*. Includes inspections in which violations were not identified.
- *Inspections/Violations*. Includes inspections which resulted in the detection of one or more violations.
- *Inspections/No OOS Violations*. Includes inspections where violations designated as "out-of-service" were not identified.
- *Inspections/OOS Violations*. Includes inspections where one or more violations were designated as "out-of-service."

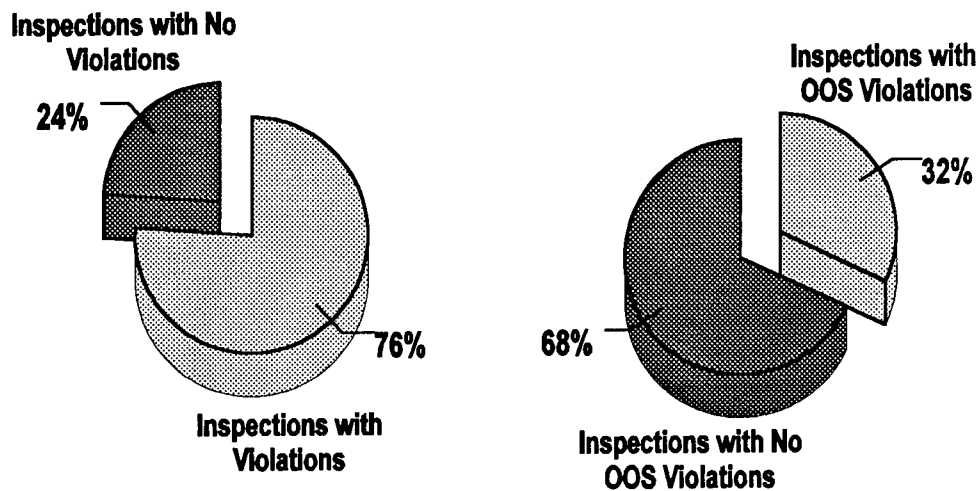
Table 1-1 summarizes the 1992 data using these inspection classes. Figure 1-1 depicts, pictorially, the relationships among the classes. Three of every four inspections contained at least one violation, and one of every three inspections contained one or more out-of-service violations. Two out of every five inspections with violations resulted in the driver or vehicle being placed out-of-service.

Figure 1-2 compares 1992 inspections, proportionally, by inspection level. The majority of inspection activities—58 percent—involved *Full Inspections*; 30 percent consisted of *Walk-Around Inspections*, while 10 percent were comprised of *Driver-Only Inspections*. The remaining two percent included *Terminal Inspections* conducted at carriers' places of business and miscellaneous *Special Studies*. Figures 1-3 and 1-4—which were derived from the numeric breakout of data in Table 1-2—offer the first evidence of a significant relationship between inspection level and inspection class. Although the percentage of inspections with violations for Full and Walk-Around Inspections was 79 and 78 percent, respectively, the proportion with

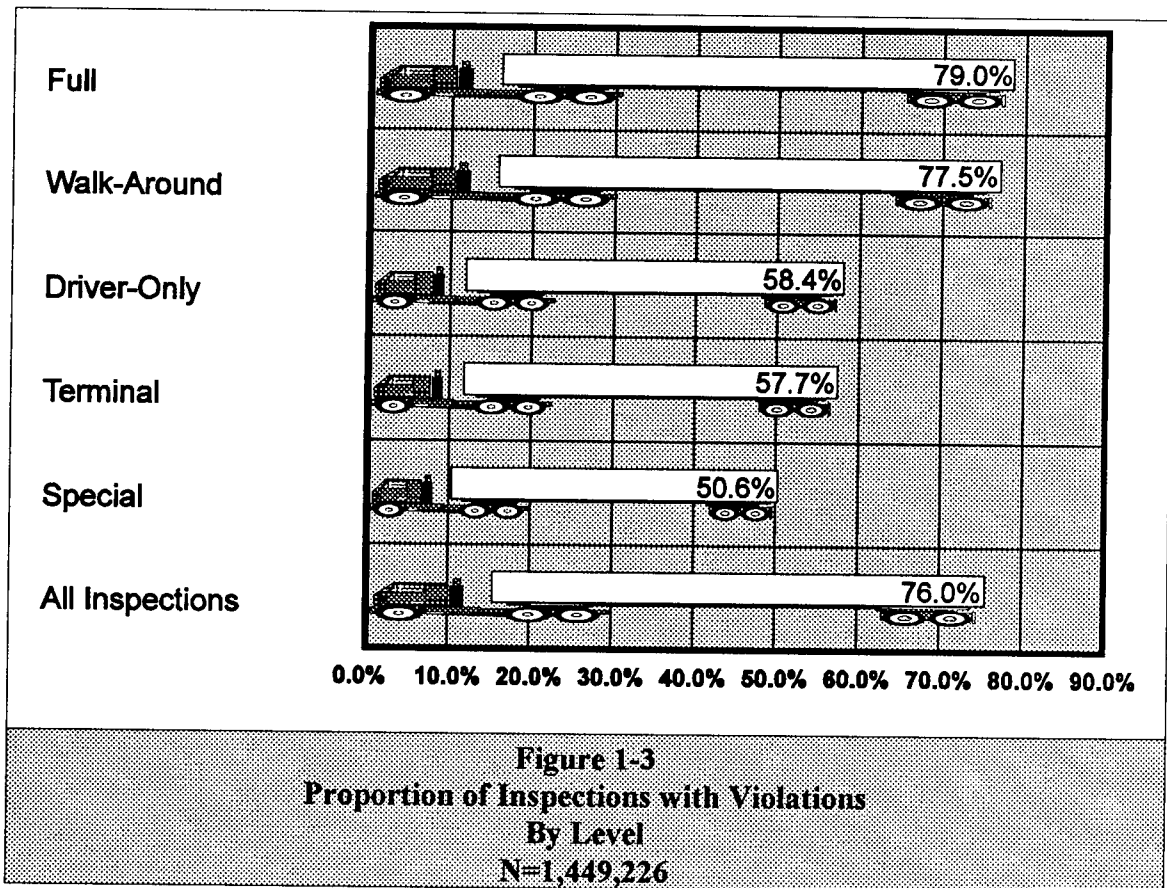
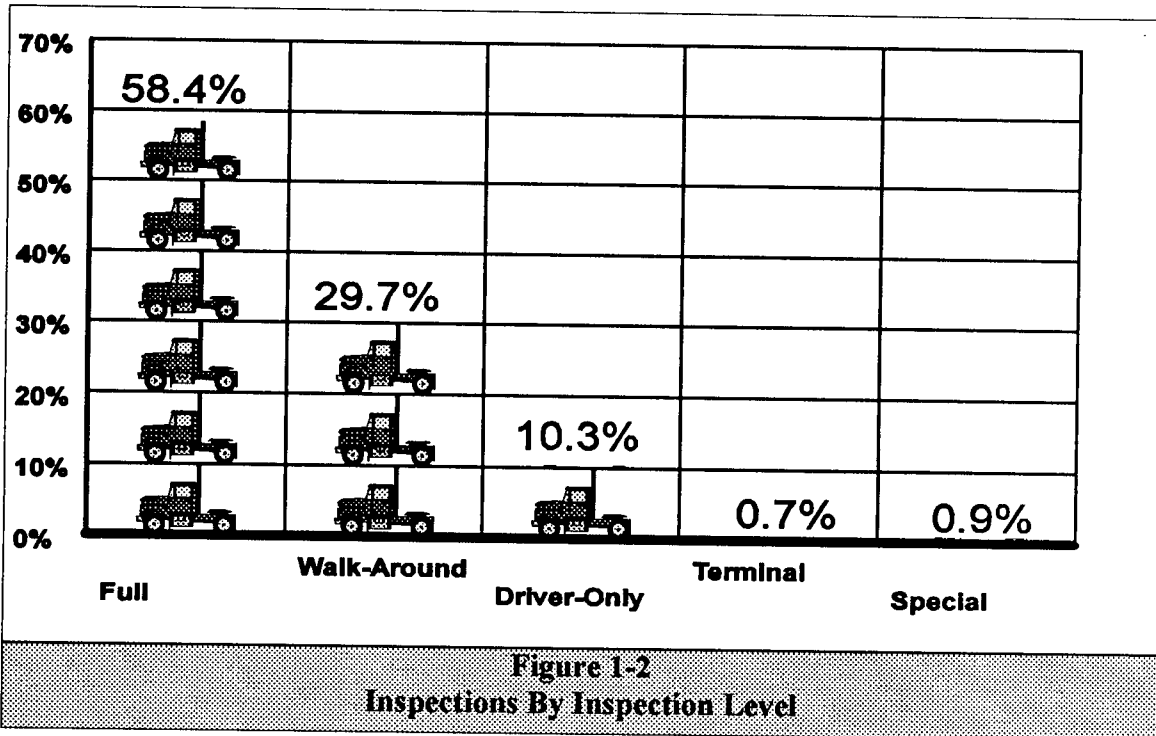
**Table 1-1**  
**1992 Inspection Totals**



Inspection Classes	Number
Inspections / No Violations	347,481
Inspections / Violations	1,101,745
Inspections / No OOS Violations	979,175
Inspections / OOS Violations	470,051
<b>Total Inspections</b>	<b>1,449,226</b>

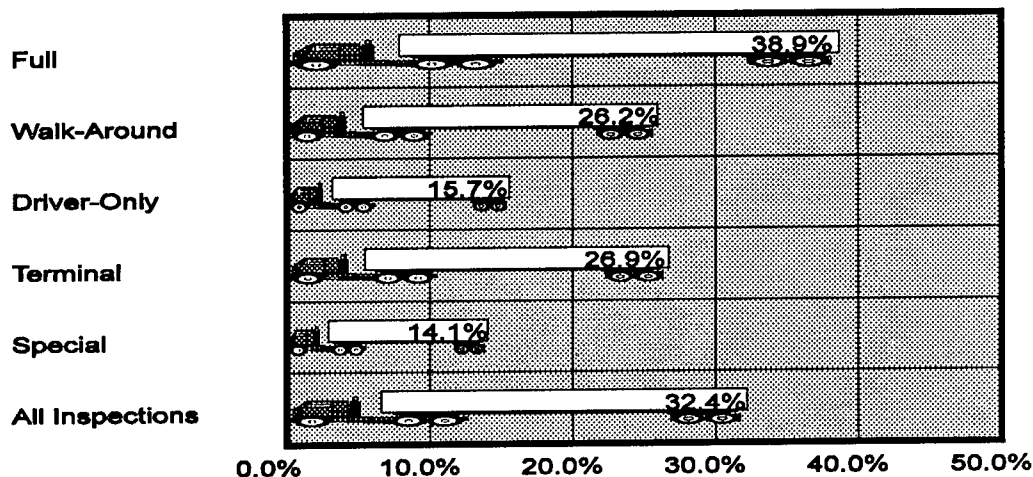


**Figure 1-1**  
**1992 Inspection Class Comparison**  
**N=1,449,226**



**Table 1-2**  
**Inspection Totals by Inspection Class**  
**And Inspection Level**

	Full	Walk-Around	Driver-Only	Terminal	Special	All Inspections
Inspections/No Violations	177,839	96,889	62,327	4,124	6,302	347,481
Inspections/Violations	668,711	333,607	87,340	5,624	6,463	1,101,745
Inspections/No OOS Violations	516,961	317,899	126,223	7,129	10,963	979,175
Inspections/OOS Violations	329,589	112,597	23,444	2,619	1,802	470,051
<b>Total Inspections</b>	<b>846,550</b>	<b>430,496</b>	<b>149,667</b>	<b>9,748</b>	<b>12,765</b>	<b>1,449,226</b>



**Figure 1-4**  
**Proportion of Inspections with Out-of-Service Violations**  
**By Level**  
**N=1,449,226**

violations for Driver-Only Inspections was just 58 percent (Figure 1-3). In other words, while Full and Walk-Around Inspections were nearly equally likely to result in the detection of at least one violation, Driver-Only Inspections tended to result in the detection of fewer violations.

Furthermore, when it came to the detection of out-of-service violations, there was a marked distinction even between Full and Walk-Around Inspections: 39 percent of Full Inspections resulted in the identifica-

tion of one or more OOS violations, as compared to only 26 percent of Walk-Arounds (Figure 1-4); just 16 percent of Driver-Only Inspections detected OOS violations. In general, movement up the continuum of inspection methodologies—from Driver-Only Inspections to Walk-Arounds to Full Inspections—appeared to increase the likelihood that OOS violations would be detected.

This relationship between inspection levels and inspection outcomes is a theme to which

we will return throughout this report.

As shown in Table 1-3, inspections with violations may be further divided into: *inspections with vehicle-only violations*, *inspections with driver-only violations*, and *inspections with both vehicle and driver violations*. Of the 1.1 million inspections with violations—non-OOS and OOS violations—58 percent involved vehicle-only violations, 26 percent contained both vehicle and driver violations, and 16 percent involved driver-only violations. Although the majority of Full and Walk-Around Inspections resulted in vehicle-only violations, Full Inspections produced proportionally more vehicle-only violations than did Walk-Arounds (69 versus 50 percent); Walk-Arounds, on the other hand, spawned proportionally more driver-only violations than did Full Inspections (17 versus 5 percent).

Similar patterns may be discerned among the 469,000 inspections containing OOS violations (Table 1-4): Full Inspections produced proportionally more vehicle-only OOS violations than did Walk-Arounds (85 versus 68 percent); again, Walk-Arounds resulted in more driver-only OOS violations than did Full Inspections (24 versus 8 percent). Full Inspections and Walk-Arounds had nearly identical proportions of inspections containing both vehicle and driver OOS violations (7 versus 8 percent).

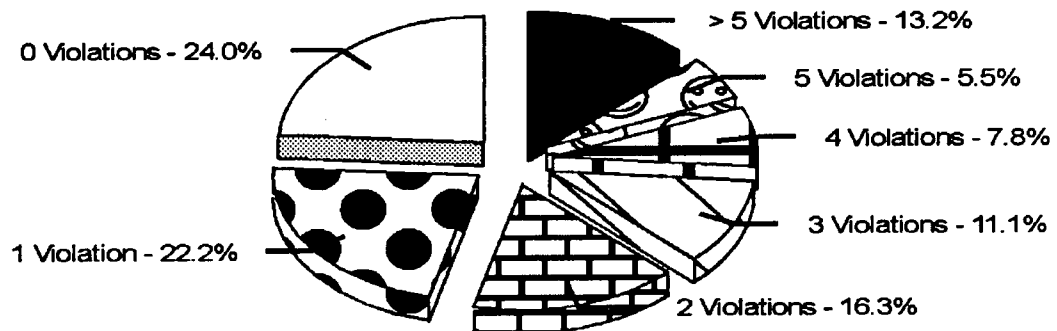
Figure 1-5 compares inspection outcomes by the number of violations identified. Fifty percent of all 1992 inspections contained one to three violations per inspection; 19 percent contained five or more violations each. Figure 1-6 looks only at those inspections with out-of-service violations: fully 41 percent of the OOS inspections contained five or more OOS violations.

**Table 1-3**  
**Proportion of Inspections with Violations**  
**By Violation Group and Inspection Level**

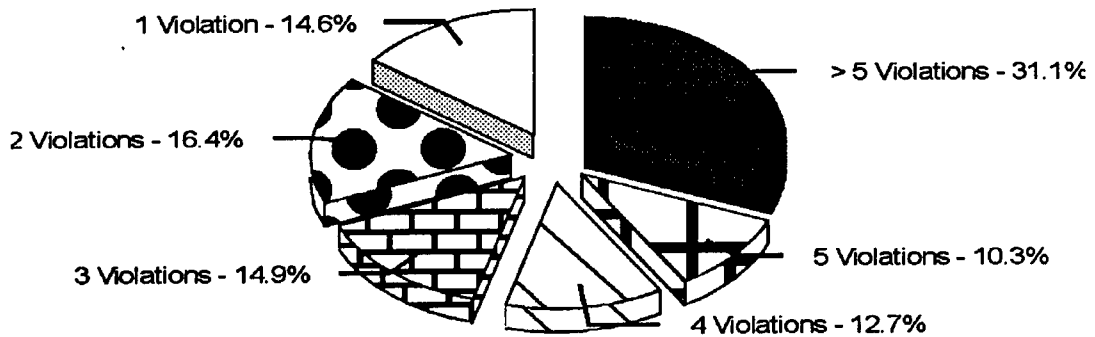
	Full	Walk-Around	Driver-Only	Terminal	Special	All Inspections
Vehicle-Only Violations	68.9%	49.7%	0.0%	100.0%	33.5%	57.5%
Driver-Only Violations	4.7%	17.1%	100.0%	0.0%	43.2%	16.2%
Both Vehicle and Driver	26.5%	33.2%	0.0%	0.0%	23.4%	26.3%
Total Inspections with Violations	668,711	333,607	87,340	5,624	6,463	1,101,745

**Table 1-4**  
**Proportion of Inspections**  
**With Out-of-Service Violations**  
**By Violation Group and Inspection Level**

	Full	Walk-Around	Driver-Only	Terminal	Special	All Inspections
Vehicle-Only OOS Violations	84.8%	68.2%	0.0%	100.0%	63.7%	76.5%
Driver-Only OOS Violations	8.0%	23.9%	100.0%	0.0%	28.6%	16.5%
Both Vehicle and Driver OOS Violations	7.2%	8.0%	0.0%	0.0%	7.7%	7.0%
Total Inspections with OOS Violations	328,604	112,504	23,443	2,601	1,801	468,953



**Figure 1-5**  
**Total Inspections by Incidence of Violations**  
**N=1,449,226**



**Figure 1-6**  
**Total Inspections with Out-of-Service Violations**  
**By Incidence of Out-of-Service Violations**  
**N=468,953**

## VIOLATION COUNTS

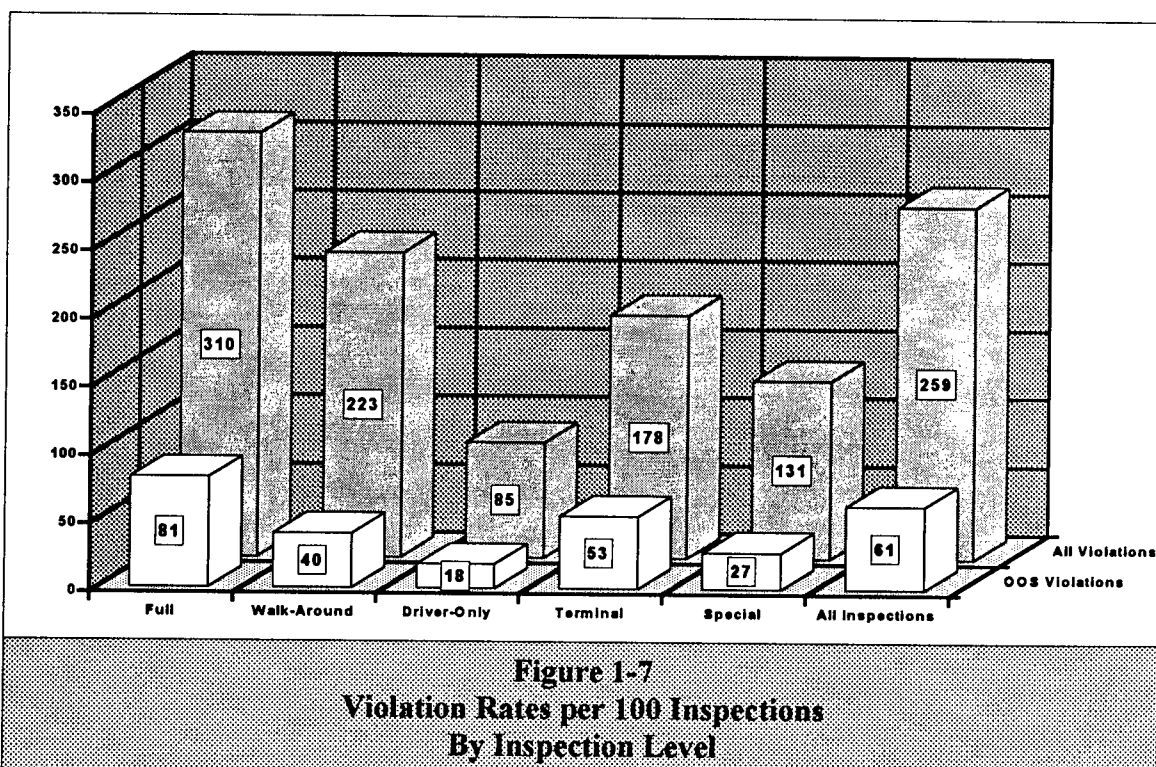
The 1.5 million driver-vehicle inspections of interstate carriers in 1992 involved more than 3.7 million violations, including 0.9 million out-of-service violations (see Table 1-5). The average inspection resulted in 2.6 violations and 0.6 out-of-service violations.

Figure 1-7 compares *violation rates*—measured as the mean number of violations per 100 inspections—for each inspection level.

In general, the data reinforce what was observed in the preceding section: namely, that the more thorough the inspection methodology, the larger will be the volume of violations likely to be detected. For every 100 Full Inspections conducted in 1992, 310 violations (including 81 OOS violations) were, on average, identified. This compares to 223 violations (including 40 OOS violations) for Walk-Arounds and 85 violations (including 18 OOS violations) for Driver-Only Inspections. This compares to 178 violations (including 53 OOS violations) for Terminal Inspections, 131 violations (including 27 OOS violations) for Special Inspections, and 259 violations (including 61 OOS violations) for All Inspections.

**Table 1-5**  
Violation and Out-of-Service Violation Counts  
By Inspection Level

	Full	Walk-Around	Driver-Only	Terminal	Special	All Inspections
<b>Total Violations</b>	2,627,315	961,743	126,803	17,317	16,732	3,749,910
<b>Total OOS Violations</b>	684,138	171,111	26,255	5,201	3,387	890,092
<b>Total Inspections</b>	846,550	430,496	149,667	9,748	12,765	1,449,226



Looking at the data this way offers potentially valuable insights. For example, in the previous section (see Figure 1-3), it was observed that inspections were equally likely to result in the identification of at least one violation, regardless of whether Full Inspections or Walk-Arounds were conducted. Here, however, the data strongly support the argument that Full Inspections, as opposed to Walk-Arounds, are likely to result in the discovery of a larger number of violations per inspection.

This, of course, does not mean that Full Inspections are always, necessarily, the methodology of choice. For one thing, Full Inspections generally require more time to perform than do the other inspection levels. For another, the comparisons shown in Figure 1-7 are quantitative, not qualitative.

Without even examining the specific violations identified by the various inspection methodologies, one can still begin to make qualitative comparisons. One way to do this is to look at differences in the ratios of *total violations* to total out-of-service violations among the methodologies, on the assumption that those vehicle and driver violations having the highest potential to imperil public safety are designated "out-of-service." A ratio of 1:1 would mean that every violation identified was OOS; a ratio of 10:1 would mean that for every ten violations identified, one was OOS. The utility of this exercise is that it reveals differences in the abilities of the various inspection methodologies to identify critical OOS violations.

Figure 1-8 graphically depicts the ratios of total violations to OOS violations. The average for all levels of inspections is 4.2:1,

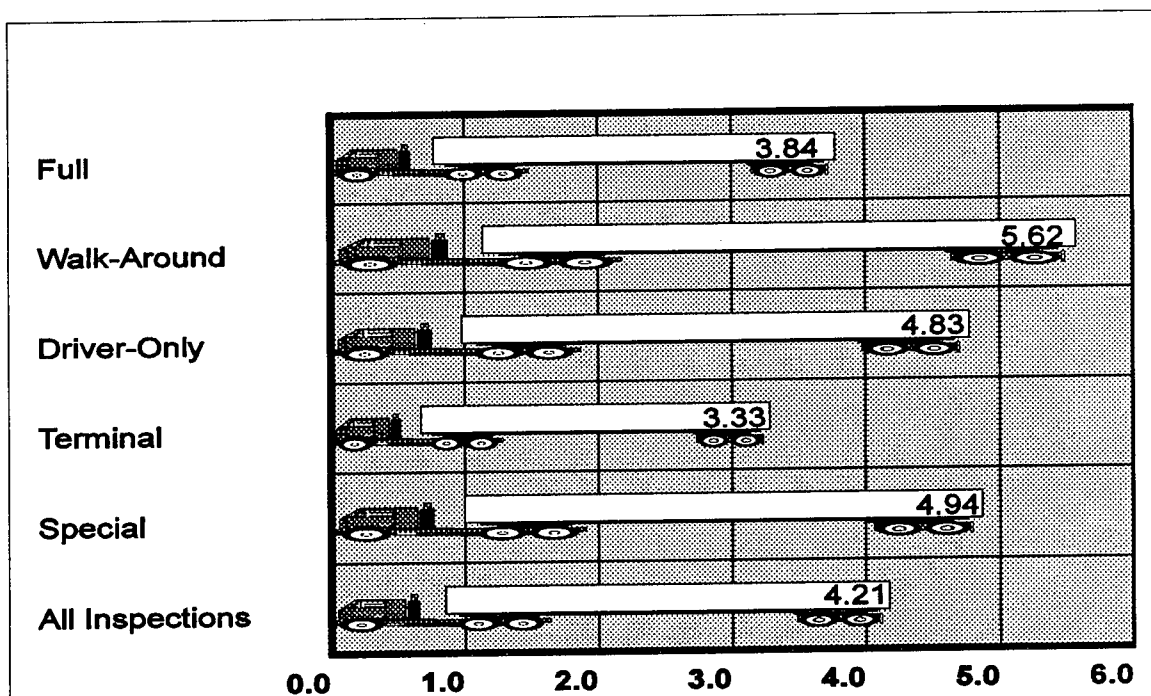


Figure 1-8  
Ratios of Total Violations  
To Out-of-Service Violations  
By Inspection Level  
N=1,449,226

which means that for every 4.2 violations cited, one violation resulted in the vehicle or driver being placed out-of-service. In other words, Full Inspections (with a ratio of 3.8:1) were much more likely than Walk-Arounds (5.6:1) and Driver-Only Inspections (4.8:1) to produce OOS violations. Interestingly, Terminal Inspections—not Full Inspections—exhibited the lowest violations/OOS violations ratio at 3.3:1.

## SUMMARY OF DEFECTS

Violations identified during the inspection process may be grouped according to whether the defect pertained to the *vehicle*, *driver*, or *hazardous materials*. Figure 1-9, on the following page, depicts the relationships among the three defect groups for 1992; the charts were prepared using the data shown in Table 1-6. Seventy-

Table 1-6 Violation and Out-of-Service Violation Counts By Defect Group		
	All Violations	OOS Violations
Vehicle	2,854,115	718,892
Driver	823,261	149,462
HazMat	63,769	20,962
Unidentified	8,165	776
Total	3,749,310	890,092

six percent of all violations—and 81 percent of OOS violations—involved defects to the vehicle. Most of the remaining violations pertained to drivers. Figure 1-10 compares the ratio of total violations to OOS violations by defect group: one out of every three hazardous materials violations resulted in an out-of-service citation; this contrasts with one out-of-service violation for almost every six driver violations. Indeed, this is

consistent with general perceptions that violations involving hazardous materials frequently imperil the public safety and are, therefore, more likely to result in OOS citations.

Figure 1-11 compares violation rates by inspection level for vehicle and driver defects. Averages of 197 vehicle violations and 57 driver violations per 100 inspections were detected across all inspection levels. However, violation rates for individual inspection levels deviated significantly from the averages. For example, when Full Inspections were conducted, the proportion of vehicle violations increased beyond the average (to 260 per 100 inspections), but the proportion of driver violations decreased (to 46 per 100 inspections). In general, Full Inspections detected the largest number of vehicle violations, while Driver-Only Inspections identified the greatest number of driver violations (83 per 100 inspections). Walk-Arounds detected more driver violations than Full Inspections (71 per 100 inspections), and many more vehicle violations than Driver-Only Inspections (145 per 100 inspections).

Similar patterns may be observed when OOS violation rates by inspection level are compared (Figure 1-12). Interestingly, vehicle violations detected during Full Inspections were much more likely to result in OOS citations (1 out of 3.7 violations) than were those observed during Walk-Arounds (1 out of 5.6 violations), perhaps because the majority of brake violations were detected during Full Inspections. This differential across the two inspection levels, though still present, was much less pronounced when driver violation rates were compared.

Examination of violation rates for hazardous materials was limited, of course, only to

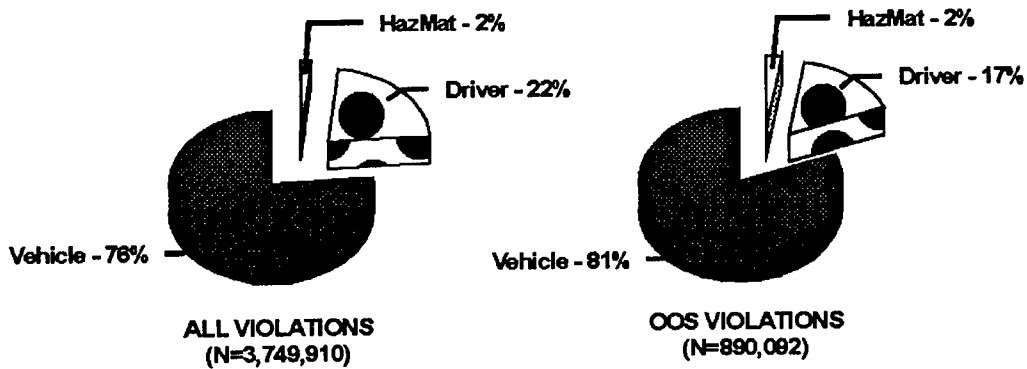


Figure 1-9  
Violation Summary  
By Defect Group

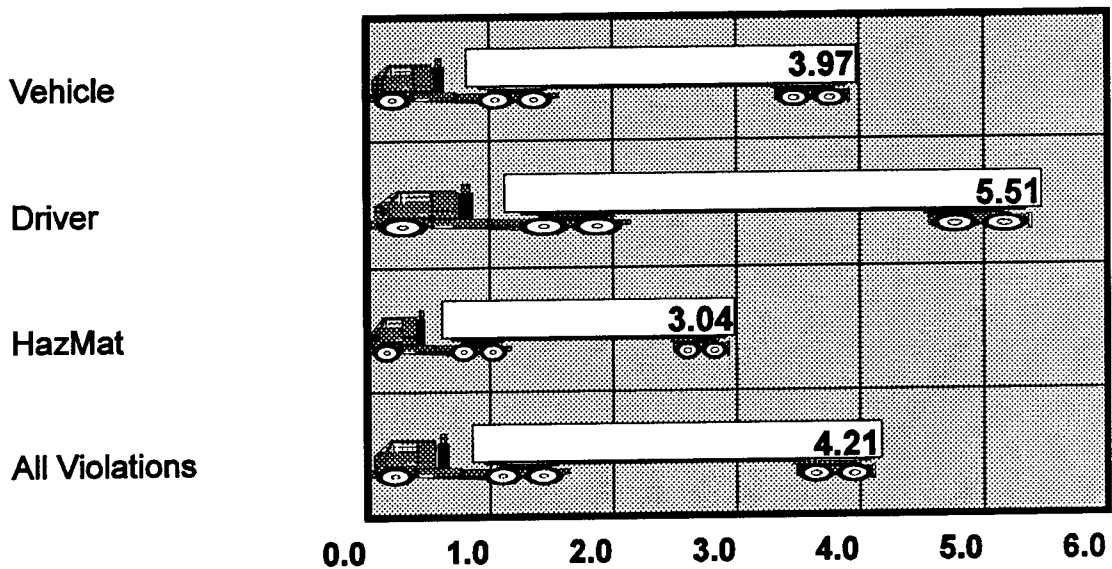


Figure 1-10  
Ratios of Total Violations  
To Out-of-Service Violations  
By Defect Group

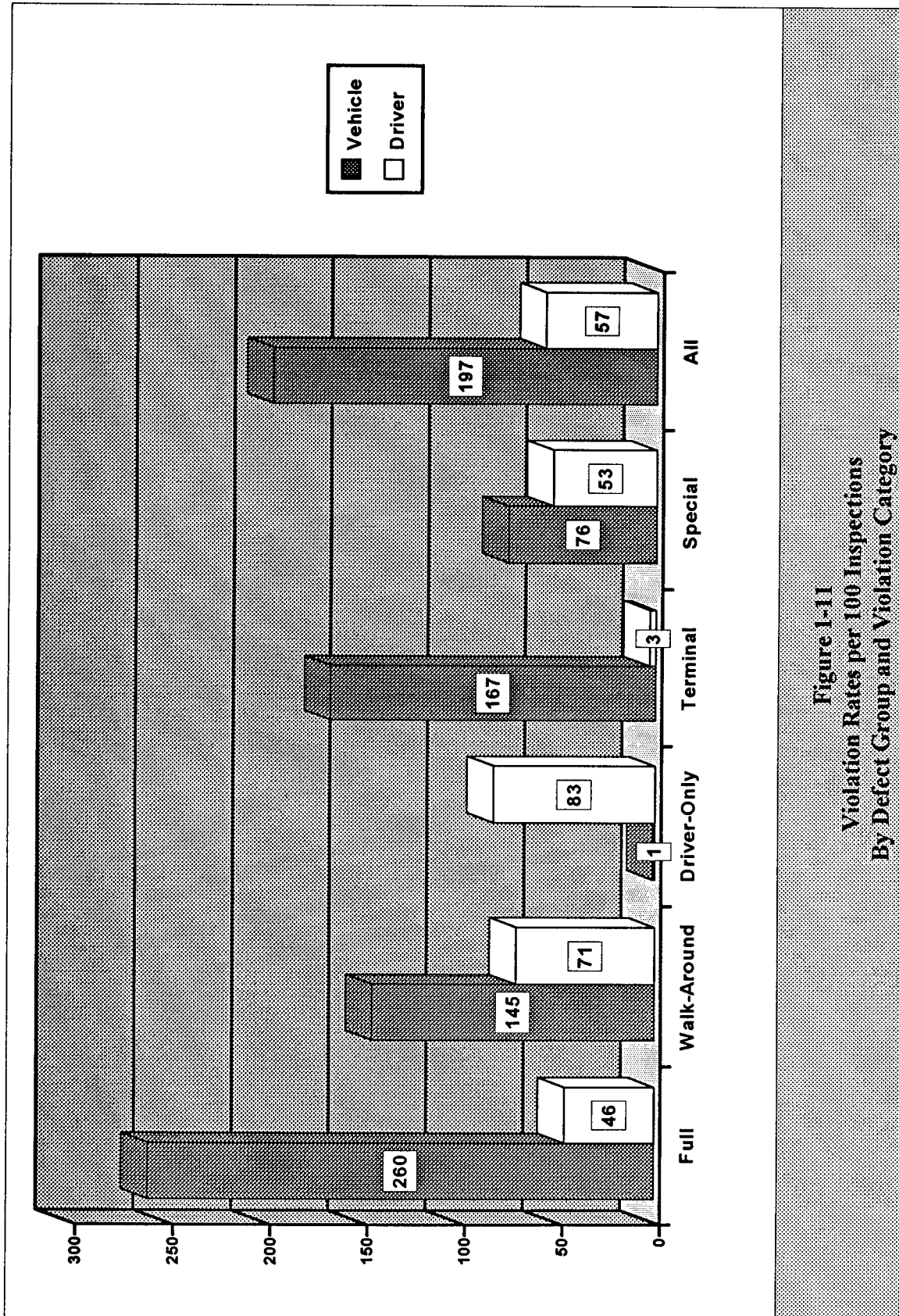
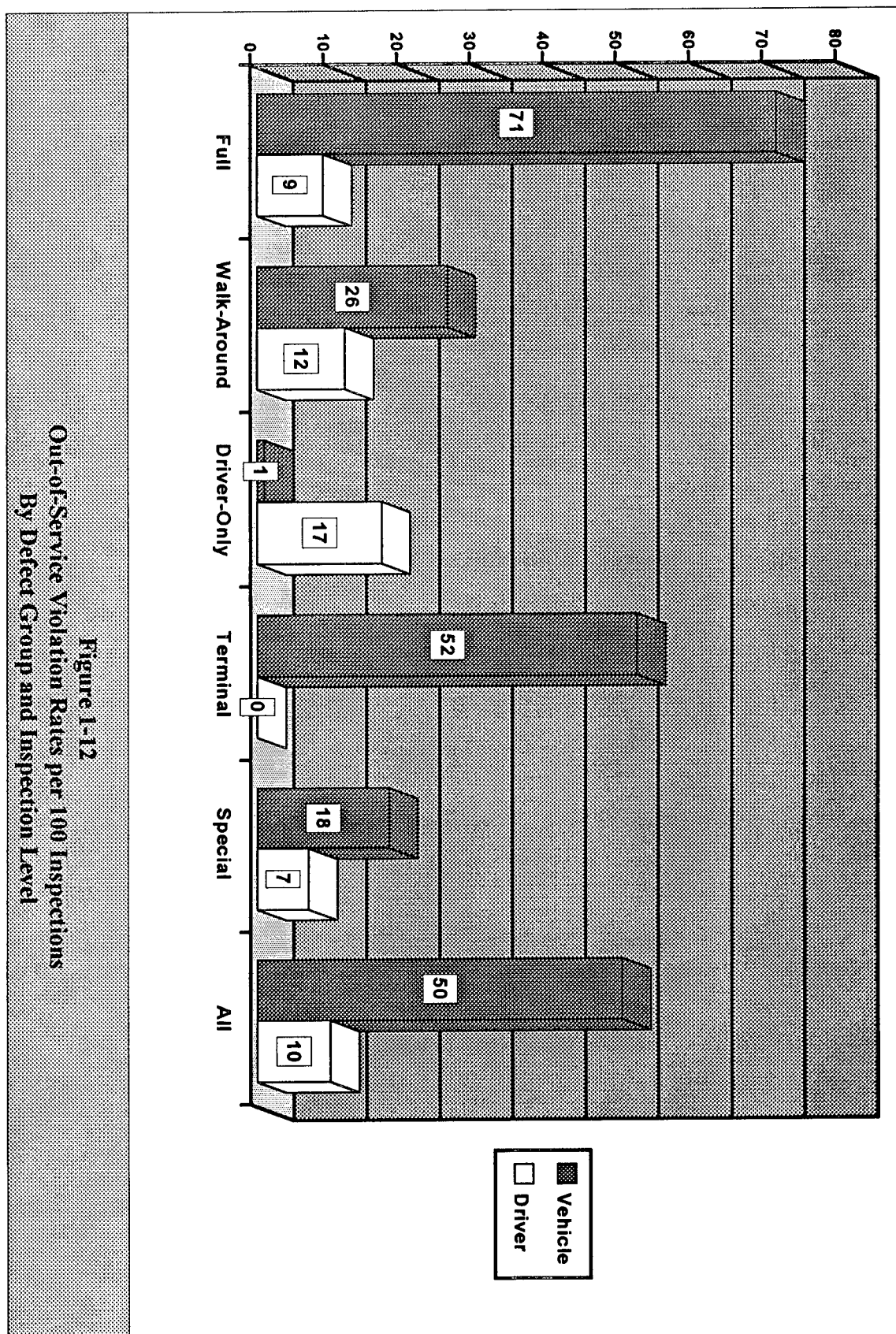


Figure 1-11  
Violation Rates per 100 Inspections  
By Defect Group and Violation Category



those inspections where the vehicles were transporting hazardous materials at the time of the inspection. Figure 1-13 shows that 10 percent of all inspections involved hazardous materials.

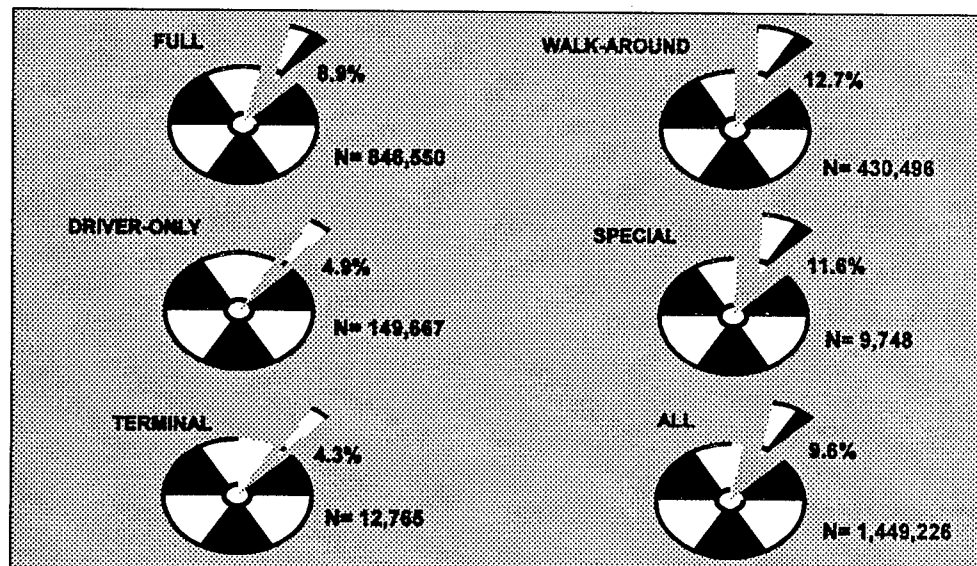
Figure 1-14 compares hazardous materials violation rates by inspection level. In general, the violation rate for hazardous materials was lower than the rate for vehicle and driver violations: there were 46 hazardous materials violations per 100 "hazmat" inspections versus 197 and 57, respectively, for vehicle and driver violations. The rate of hazardous materials OOS violations versus driver OOS violations, however, was more significant—there were 15 hazardous materials OOS violations per 100 "hazmat" inspections versus only 10 driver OOS violations.

Finally, according to the 1992 data, Walk-Arounds were more likely to detect hazardous materials violations (54 violations per

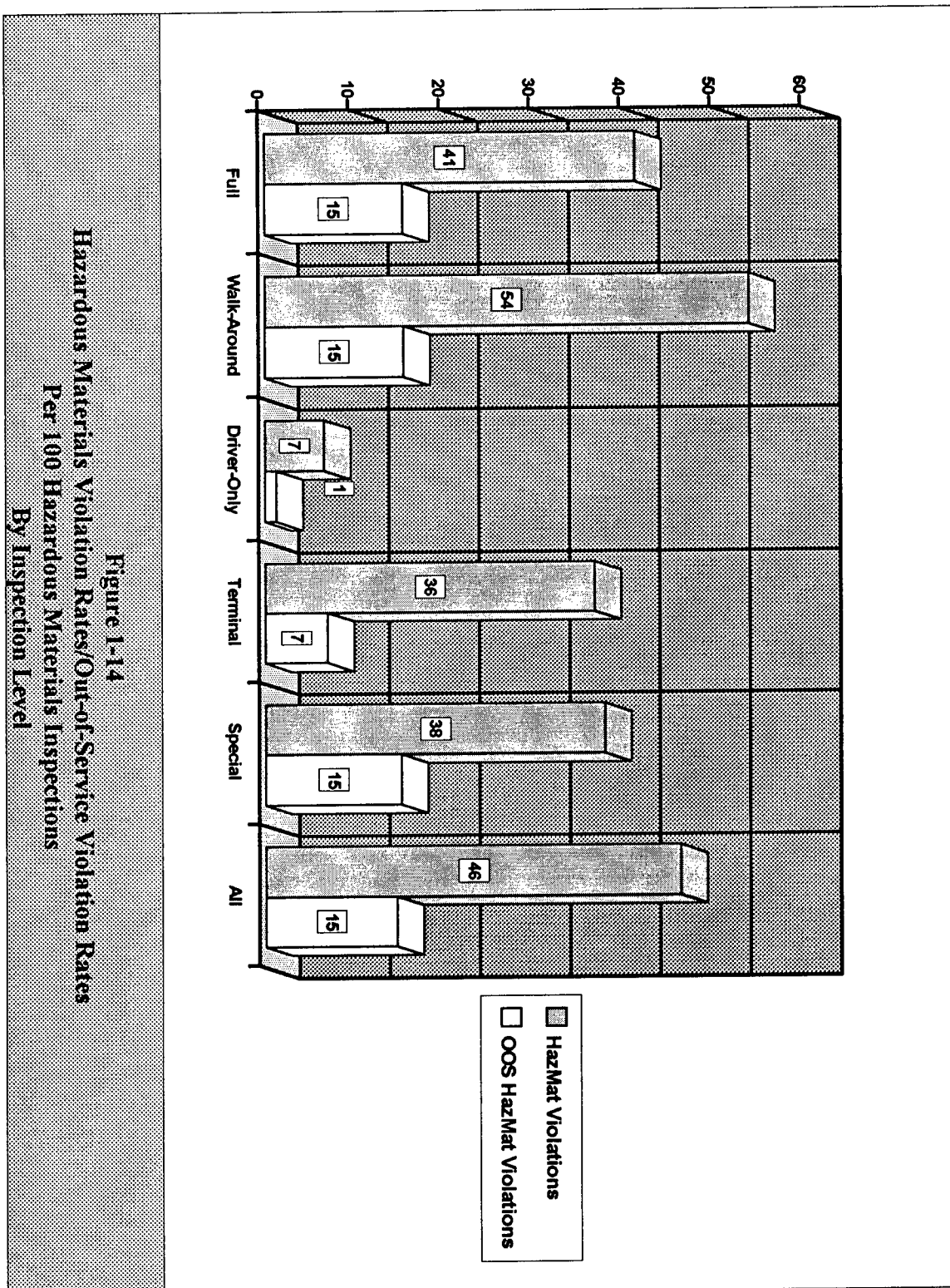
100 "hazmat" inspections) than were Full Inspections (41 violations per 100 inspections); both types of inspections detected an average of 15 hazardous materials OOS violations per 100 hazmat inspections.

Table 1-7 shows counts for specific violations which recur under the three defect groups: vehicle, driver, and hazardous materials. ("Other" refers to violations containing insufficient information to be attributable to any of the defect groups.) Figures 1-15 through 1-17 compare violation and OOS violation rates within each of the defect groups. Again, the hazardous materials violation rates (Figure 1-17) were calculated only for those inspections involving hazardous materials.

Figure 1-18 compares violation rates, by inspection level, for selected defects: (1) brakes, (2) lighting, (3) hours-of-service, (4) improper placarding, and (5) improper shipping papers. Brakes accounted for more than 25 percent of all inspection defects

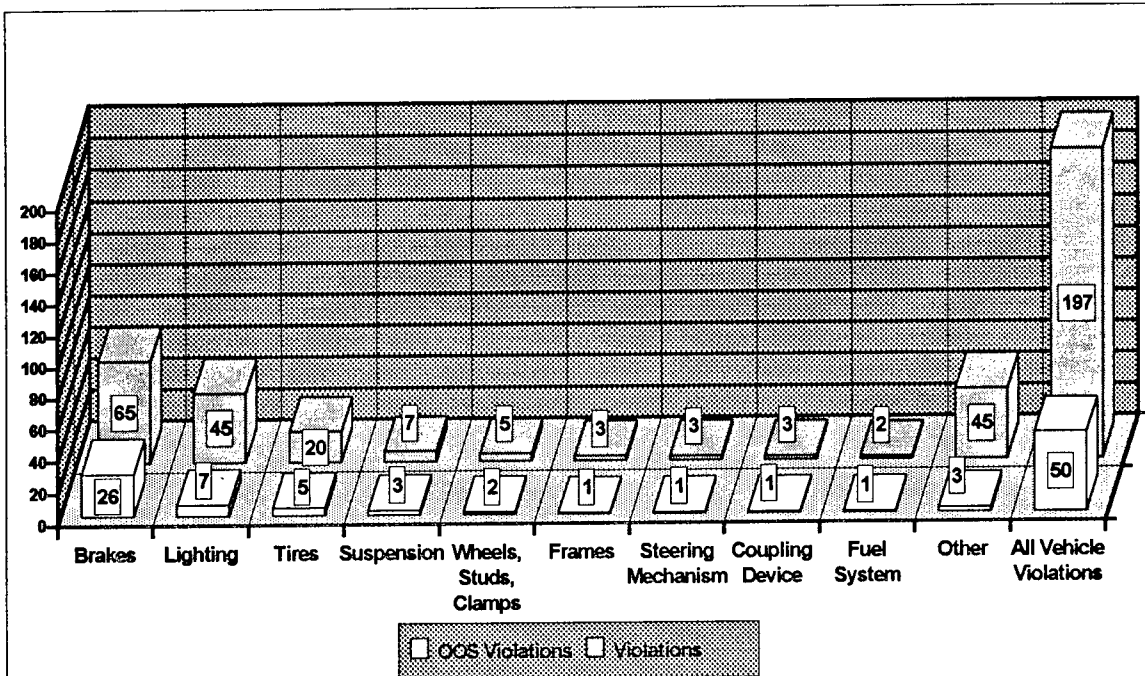


**Figure 1-13**  
Proportion of Inspections  
Involving Hazardous Materials

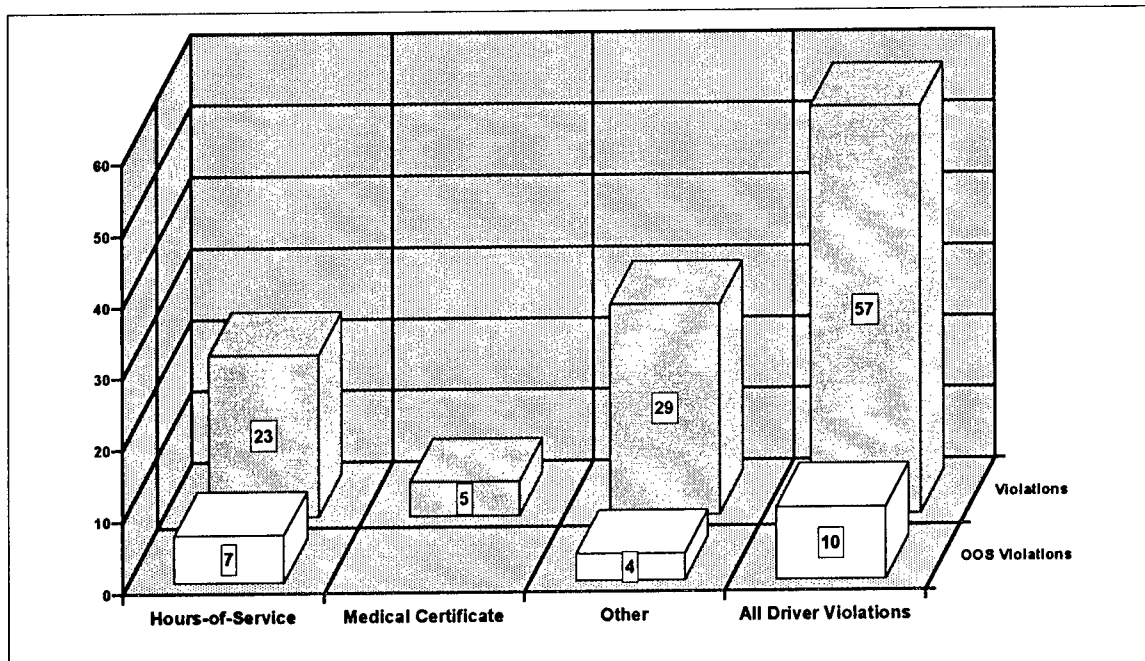


**Table 1-7**  
**Violation and Out-of-Service Violation Counts**  
**By Specific Defect**

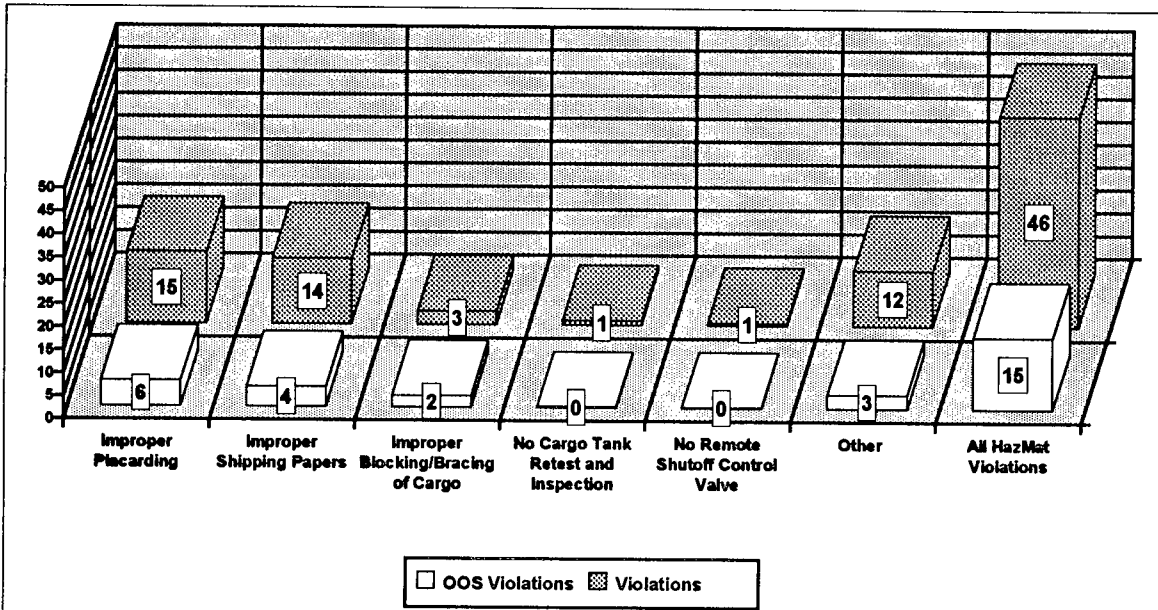
	Number of Violations	Percent of Violations	Number of OOS Violations	Percent of OOS Violations
<b>VEHICLE</b>				
Brakes	945,081	25.2%	383,206	43.1%
Lighting	647,535	17.3%	102,258	11.5%
Tires	283,933	7.6%	70,240	7.9%
Suspension	98,900	2.6%	41,749	4.7%
Wheels, Studs, Clamps	69,025	1.8%	23,747	2.7%
Frames	46,120	1.2%	12,404	1.4%
Steering Mechanism	45,399	1.2%	14,990	1.7%
Coupling Devices	38,568	1.0%	14,172	1.6%
Fuel System	27,711	0.7%	11,474	1.3%
Other Vehicle Defects	652,443	17.4%	44,652	5.0%
<b>DRIVER</b>				
Hours of Service	327,382	8.7%	94,585	10.6%
Medical Certificates	68,646	1.8%	1,899	0.2%
Other Driver Violations	427,233	11.4%	52,978	6.0%
<b>HAZMAT</b>				
Improper Placarding	21,474	0.6%	7,720	0.9%
Improper Shipping Papers	19,569	0.5%	5,980	0.7%
Improper Blocking and Bracing of Cargo	4,137	0.1%	3,375	0.4%
No Cargo Tank Retest and Inspection	1,384	0.0%	225	0.0%
No Remote Shutoff Control	735	0.0%	172	0.0%
Improperly Marked Shipment	433	0.0%	51	0.0%
Use of Non-Specification Container	243	0.0%	68	0.0%
Other HazMat Violations	15,794	0.4%	3,371	0.4%
<b>OTHER</b>	8,165	0.2%	776	0.1%
<b>ALL</b>	3,749,910	100.0%	890,092	100.0%



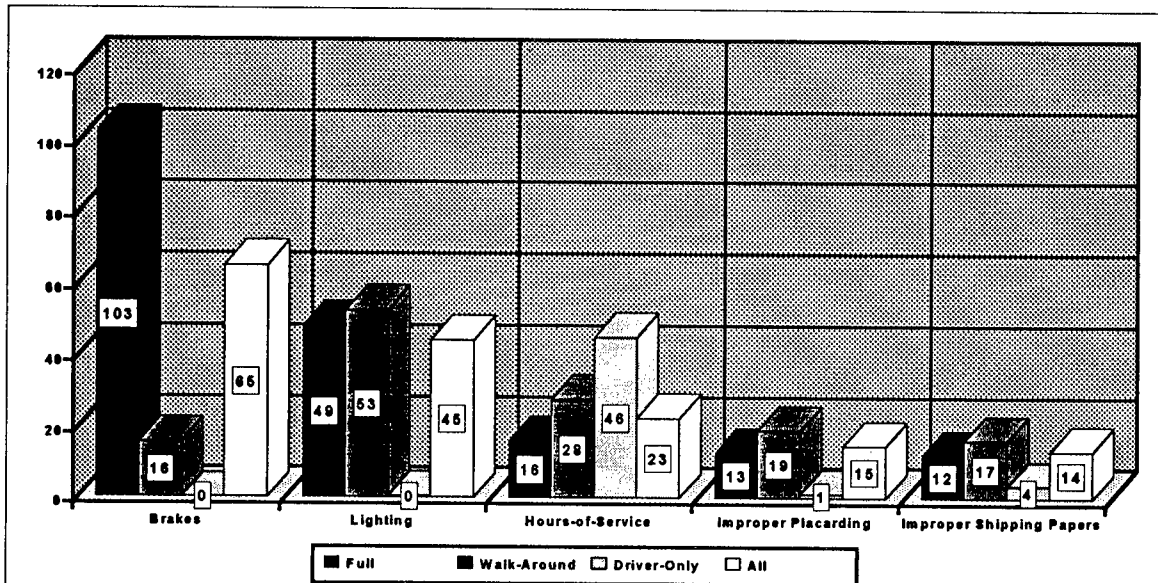
**Figure 1-15**  
**Vehicle Violation and Out-of-Service Violation Rates**  
**Per 100 Inspections by Defect Type**  
**N=1,449,226**



**Figure 1-16**  
**Driver Violation and Out-of-Service Violation Rates**  
**Per 100 Inspections by Defect Type**  
**N=1,449,226**



**Figure 1-17**  
**Hazardous Materials Violations and Out-of-Service Violation Rates**  
**Per 100 Hazardous Materials Inspections**  
**By Defect Type**



**Figure 1-18**  
**Selected Defects by Inspection Level**  
**Violation Rates per 100 Inspections**

identified in 1992, and nearly all of these defects were detected during Full Inspections. Walk-Arounds identified comparatively few brake violations, but consistently detected a higher incidence of non-brake violations than did Full Inspections. As expected, Driver-Only Inspections most adeptly identified hours-of-service violations, but were almost uniformly unable to detect non-driver violations.

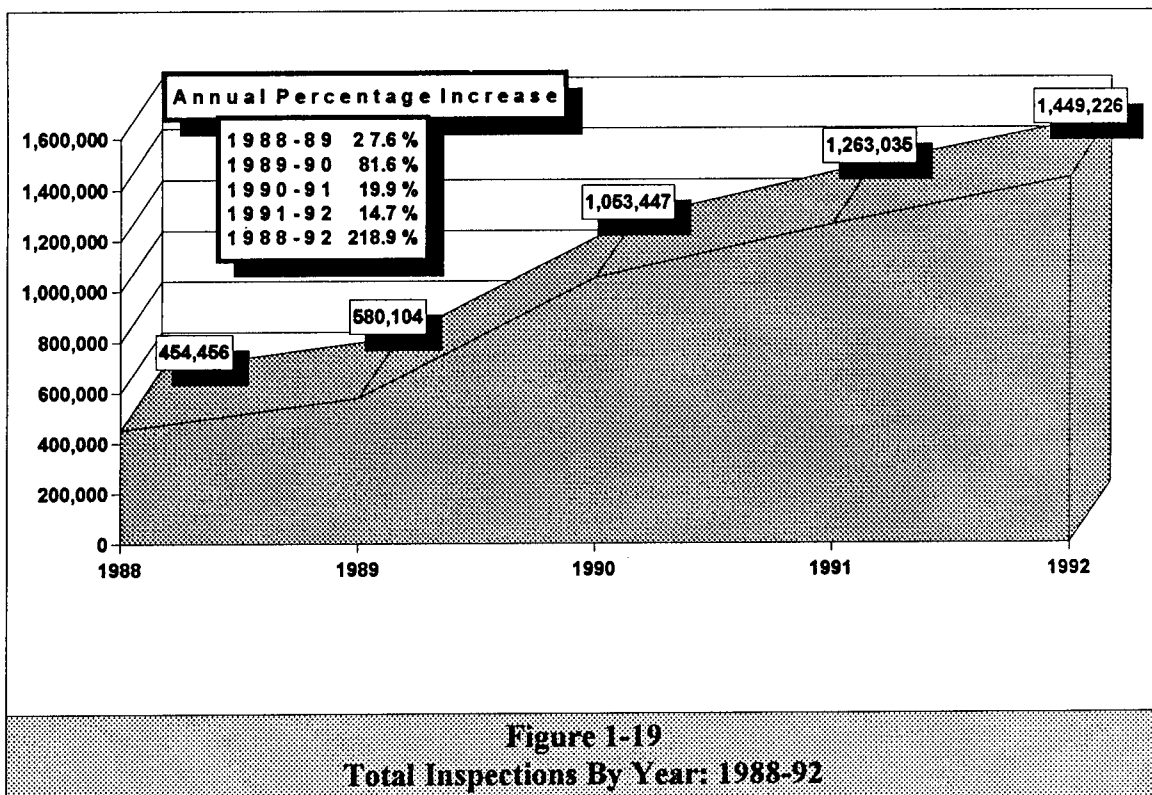
## FIVE-YEAR TRENDS

During the five-year period, 1988-92, 4.8 million inspections of interstate carriers were conducted. Total inspections performed increased 219 percent, from less than 500,000 in Calendar Year 1988 to almost 1,500,000 in Calendar Year 1992 (Figure 1-19). While the raw number of inspections increased each year, the largest annual increase in total inspections—82

percent—occurred in 1990. The number of inspections completed in 1992 increased by 15 percent over the 1991 totals.

Figures 1-20 and 1-21 compare the raw counts of violations and OOS violations by year. Although during the earliest years, 1988-90, the incidence of violations and OOS violations increased at a faster annual pace than the frequency of inspections, this trend reversed itself in subsequent years. For example, in 1992, when annual inspections performed grew by 15 percent, total violations increased by just 3 percent and total OOS violations actually declined by almost 3 percent.

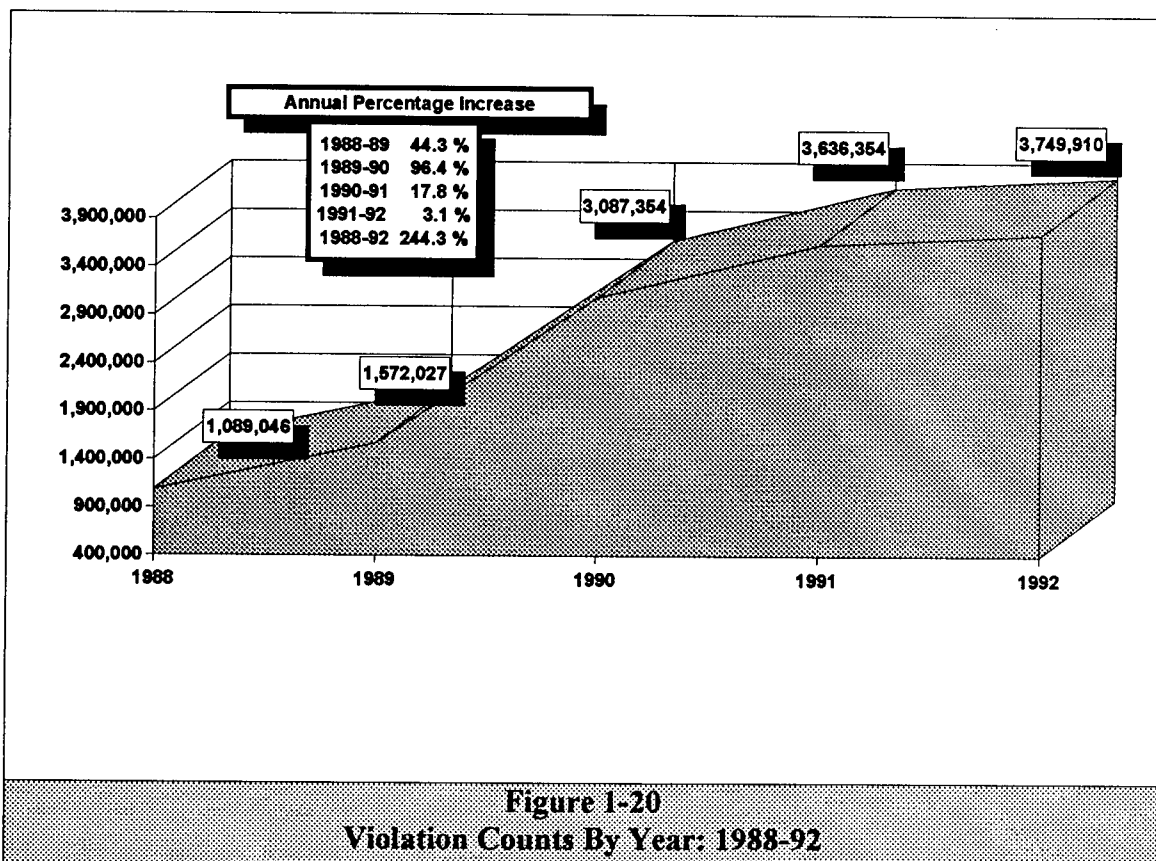
The general trend becomes more apparent when the violation and OOS violation rates are compared for the five-year period (Figure 1-22). Both the violation and OOS violation rates peaked, in 1990, at 293 and 75, respectively, per 100 inspections. By 1992,

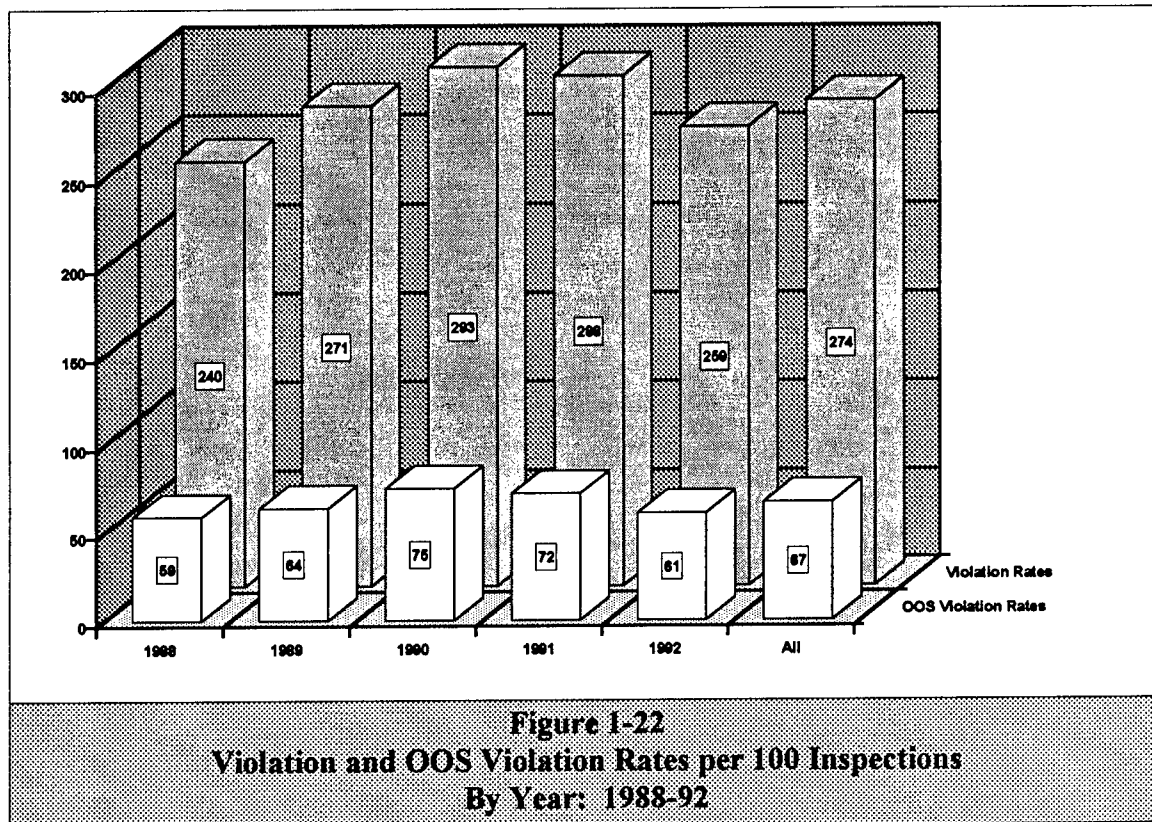
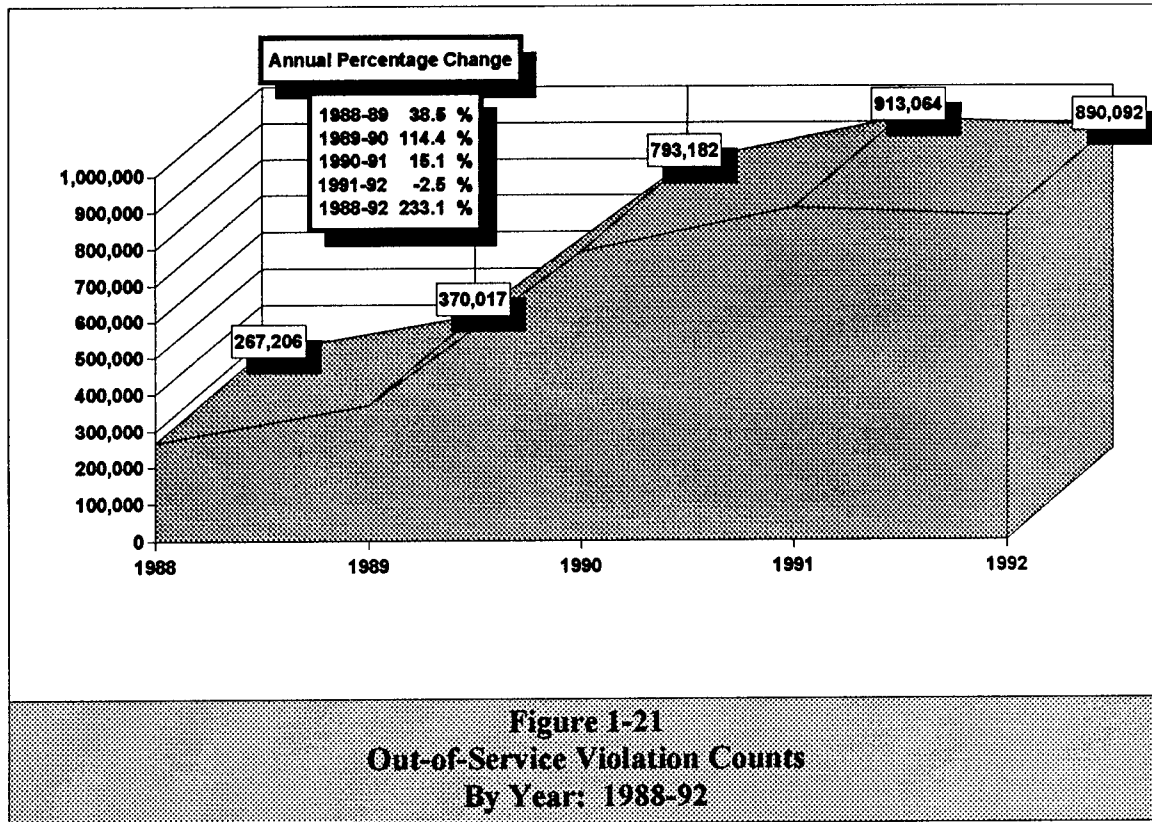


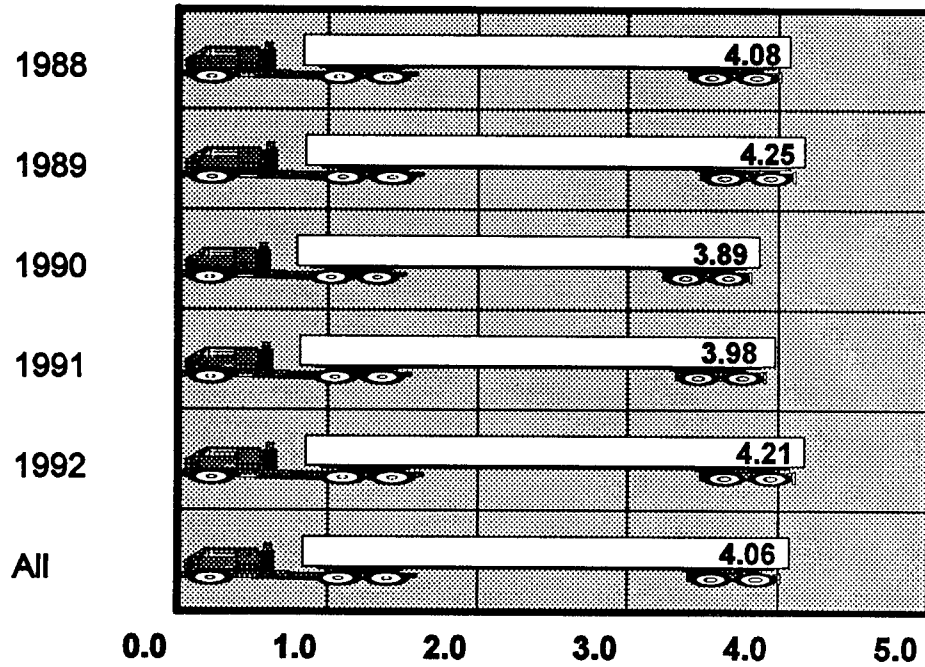
the rates had declined to 259 violations, and 61 OOS violations, per 100 inspections. One possible explanation for this trend is that recent public and private initiatives to improve the safety fitness of commercial vehicles were—towards the end of the five-year period—beginning to have a positive impact on inspection outcomes. The data presented here, however, are not adequate to definitively support—or refute—this conclusion.

service citation; by 1992, only one in 4.2 violations produced an out-of-service citation.

Figure 1-23 examines the ratio of total violations to OOS violations. Even though the ratio did not fluctuate significantly over the five years, there may have been nominal improvement in the severity of violations between 1990 and 1992: in 1990, 1 out of every 3.9 violations resulted in an out-of-







**Figure 1-23**  
**Ratios of Total Violations**  
**To Out-of-Service Violations**  
**By Year: 1988-92**



## CHAPTER 2

### *The Impact of Carrier and Vehicle Attributes*

Carrier Summary  
Carrier Type  
Fleet Size  
Vehicle Configuration  
Hazardous Materials

Approximately 4 out of 5 inspections of interstate carriers performed in 1992 were attributable to "known" carriers. Of the known carriers, 40 percent were inspected 100 or more times each during the year, and 17 percent had over 500 inspections apiece; the average carrier was inspected 10 times during the year. Three of 4 inspections where carrier type was discernible involved for-hire carriers, and 1 of 2 inspections where fleet size was known consisted of carriers operating 38 power units or less. In general, there was a strong inverse relationship between carrier fleet size and inspection outcomes—larger carriers had consistently lower violation rates than did smaller carriers. Nine of 10 inspections involved tractor-trailers, mostly singles; vehicle violation rates for singles were slightly lower—while driver violation rates were considerably higher—than for doubles and triples. Buses, by far, had the lowest violation rate of any vehicle group—whereas the violation rate for all vehicle types was 259 per 100 inspections, the rate for buses was 119. In 1 in 10 inspections, the vehicle was transporting hazardous materials at the time of the inspection; the overall violation rate for vehicles transporting hazardous materials was substantially lower than the rate for inspections where hazardous materials were not present.

### CARRIER SUMMARY

Seventy-eight percent of all interstate inspections conducted in 1992 were attributable to specific carriers; the OMC was not able to identify, positively, the carriers associated with 22 percent of the inspections (Table 2-1). (In 1993, the OMC implemented new procedures to reduce the number of "unidentified" carriers. Consequently, the number of carriers which could not be identified declined in subsequent years.) Inspections in which carriers were clearly identified involved nearly 116,000 distinct trucking entities, meaning that identified carriers were inspected a mean number of ten times each over the course of the entire year (Table 2-2). During the year, each identified carrier received, on average, citations for 24 violations and six OOS violations (Table 2-3). Figure 2-1 summarizes the breakout of violations per carrier among the three defect groups (vehicle, driver, and hazardous materials).

Table 2-4 shows a frequency distribution of inspection activity among the 116,000 companies identified by the OMC. Twenty-four percent of the carriers were inspected one to ten times in 1992. More strikingly, 40 percent of all carriers each experienced 100 or more inspections during the year, and 17 percent of the carriers had over 500 inspections each!

**Table 2-1**  
**1992 Inspections by Carrier Identification**



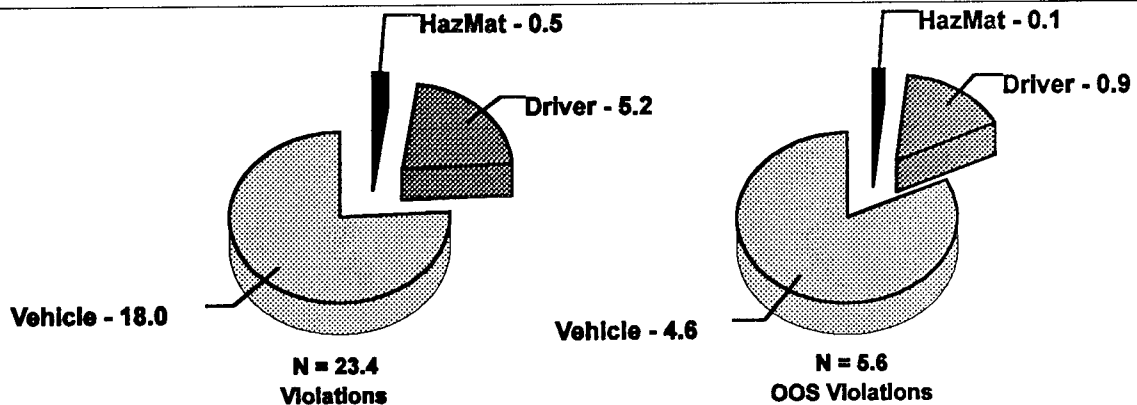
	Number	Percent
Carriers Identified	1,129,672	78
Carriers Not Identified	316,983	22
Total Inspections	1,446,655	100

**Table 2-2**  
**Inspections by Known Carriers**

	Number
Number of Inspections	1,129,672
Number of Carriers	115,721
Average Inspections per Carrier	9.8

**Table 2-3**  
**Violations by Known Carriers**

	Number
Number of Violations	2,750,089
Number of OOS Violations	658,763
Number of Carriers	115,721
Average Violations per Carrier	23.8
Average OOS Violations per Carrier	5.7

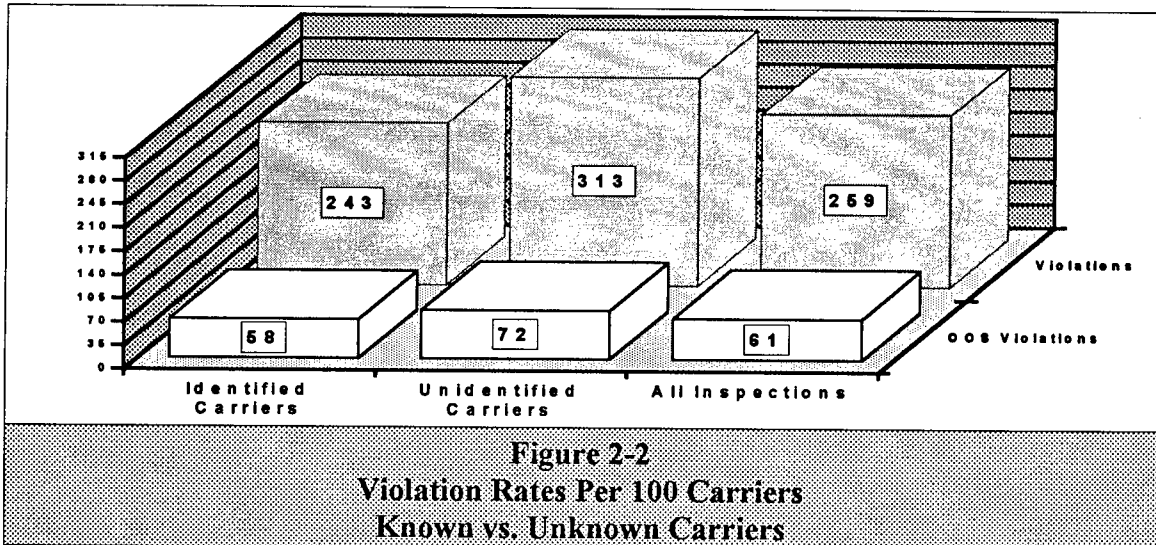


**Figure 2-1**  
**1992 Violation Breakout by Known Carriers**  
**Average Annual Violations Per Carrier**

**Table 2-4**  
**Inspection Activity**  
**Frequency**

Number of Inspections	Frequency
1 to 10	23.5%
11 to 25	13.1%
26 to 50	11.9%
51 to 75	7.1%
76 to 100	4.8%
101 to 200	10.8%
201 to 500	11.8%
Over 500	17.0%
All	100.0%

Figure 2-2 compares two sets of inspection outcomes: (1) inspections where the OMC clearly identified the carriers involved, and (2) inspections where the carriers could not be identified. The violation rate for the group of "identified" carriers was significantly lower (243 per 100 inspections) than the rate for the "unidentified" carriers (313 per 100 inspections). The OOS violation rate was also very different—58 per 100 inspections for "identified" carriers versus 72 for "unidentified" carriers. In other words, the population of obscure, hard-to-identify carriers experienced, on average, 25-30 percent more violations per inspection than did the group of "identified" carriers.



**Table 2-5**  
**Inspections by Carrier Type**  
**Known Carriers**

	Number	Percent
For-Hire Authorized	795,930	70.5%
For-Hire Exempt	34,536	3.1%
Private	263,690	23.3%
Both For-Hire and Private	27,033	2.4%
Other	8,483	0.8%
Total Inspections	1,129,672	100.0%

## CARRIER TYPE

Of the 1.1 million inspections in which carriers were identified, nearly three out of every four (73.6 percent) involved for-hire carriers (Table 2-5). Most of the remaining inspections (23.3 percent) involved private carriers. A relatively small number of the carriers (2.4 percent) were designated by the OMC as "both for-hire and private."

Figure 2-3 shows a breakout of the popula-

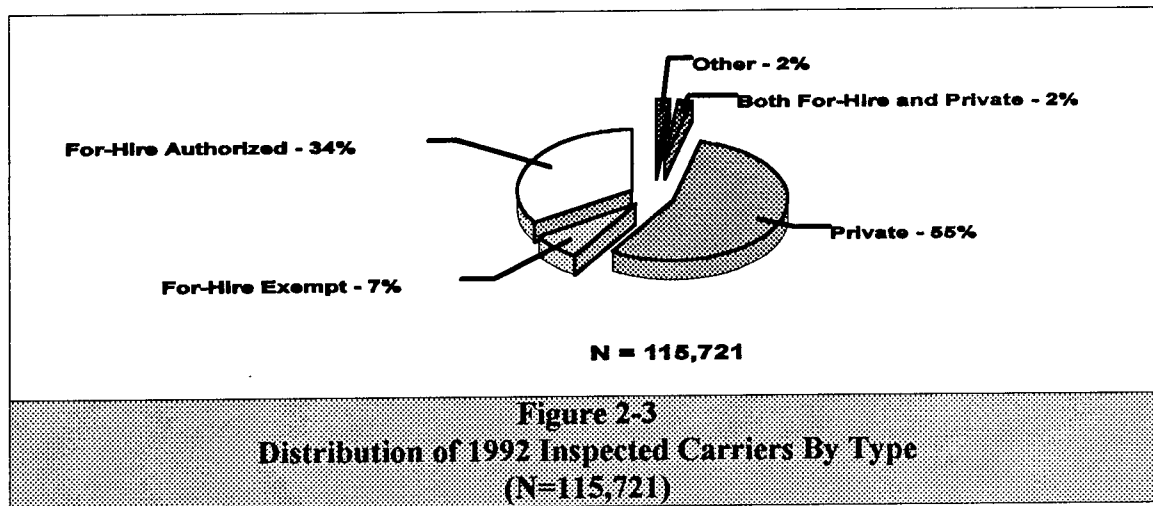
tion of identified carriers inspected in 1992. More than one-half (55 percent) of all the inspected carriers were private and only one-third (34 percent) were authorized for-hires. Yet, as seen in Table 2-5, over three times as many inspections involved authorized for-hire carriers as private carriers. Hence, at first glance, it appears that authorized for-hire carriers had a much higher probability of being inspected than private carriers.

What initially appears as a higher probability, however, turns out not to be the case at all. Perhaps authorized for-hire carriers amassed the highest proportion of inspections not because of inherent biases in the safety inspection process, but, rather, because the authorized carriers were "exposed" to the possibility of being inspected more often than any of the

other carrier types. One way to test this hypothesis is to consider the extent to which authorized for-hire carriers were on the highway—as measured by vehicle miles of travel (VMT)—relative to the other carrier types.

Table 2-6 reveals that the authorized for-hire carriers inspected in 1992 had an average fleet size of 33 vehicles per carrier, average VMT of 72,000 miles per vehicle, and average total VMT of 2.4 million miles per carrier. This contrasts with private carriers which had an average fleet size of 13 vehicles per carrier, average VMT of 49,000 miles per vehicle, and average total VMT of 0.7 million miles per carrier.

Data from Figure 2-3 and Table 2-6 were



**Table 2-6**  
**Average Fleet Size, Per Unit VMT, and VMT Per Carrier**  
**By Carrier Type**  
**Known Carriers Inspected in 1992**  
**(N=110,743)**

	For-Hire Authorized	For-Hire Exempt	Private	Both For-Hire & Private	Other
Mean No. of Power Units in Fleet	32.64	17.34	13.38	17.21	9.64
Mean VMT per Power Unit	72,276	57,325	48,725	57,147	47,425
Mean VMT per Carrier Fleet	2,359,089	994,016	651,941	983,500	457,177

used, in Table 2-7, to calculate *expected* 1992 inspection frequencies by carrier type. The expected frequencies were then compared to the *experienced* values (from Table 2-5). Based on these data, approximately 64 percent of all 1992 inspections were "expected" to involve authorized for-hire carriers; 29 percent were "expected" to involve private carriers. In practice, 71 percent of the 1992 inspections involved authorized for-hire carriers, while 23 percent involved private carriers. In other words, contrary to initial observations, the data indicate that the distribution of carrier type among 1992 inspected carriers came relatively close to reflecting the distributions among the carrier population at large. If anything, authorized for-hire carriers appeared to be slightly over-represented in inspections, while private carriers were somewhat under-represented.

Table 2-8 summarizes 1992 violation counts—and OOS violation counts—by carrier type. Figures 2-4 through 2-7 then compare the violation and OOS violation rates by carrier type. The comparison of rates for hazardous material violations in Figure 2-7 is limited to those inspections where hazardous materials were present.

There appeared to be generally meaningful differences in the violation rates of the different carrier types. Initially, one might have conjectured that these differences were more a function of fleet size than carrier type. For example, exempt for-hire carriers (average fleet size: 17 power units) experienced 274 violations per 100 inspections versus 244 violations per 100 inspections for authorized for-hire carriers (average

**Table 2-7**  
**Inspection Frequencies By Carrier Type**  
**Expected vs. Experienced Values**

	For-Hire Authorized	For-Hire Exempt	Private	Both For-Hire & Private	Other	Total
Carrier Representation in Population	34.0%	7.0%	55.0%	2.0%	2.0%	100.0%
Mean VMT per Carrier (000)	2,359	994	652	984	457	
Proportional VMT (000)	802	70	359	20	9	1,260
Inspection Proportion – Expected	63.7%	5.6%	28.5%	1.6%	0.7%	100.0%
Inspection Proportion – Experienced	70.5%	3.1%	23.3%	2.4%	0.8%	100.0%

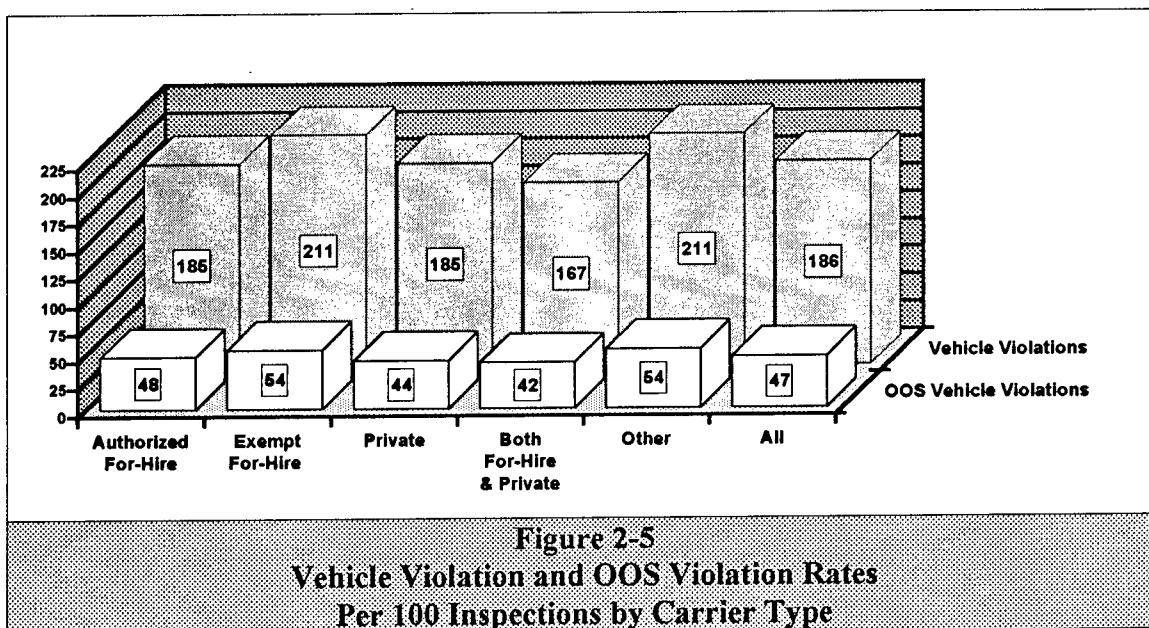
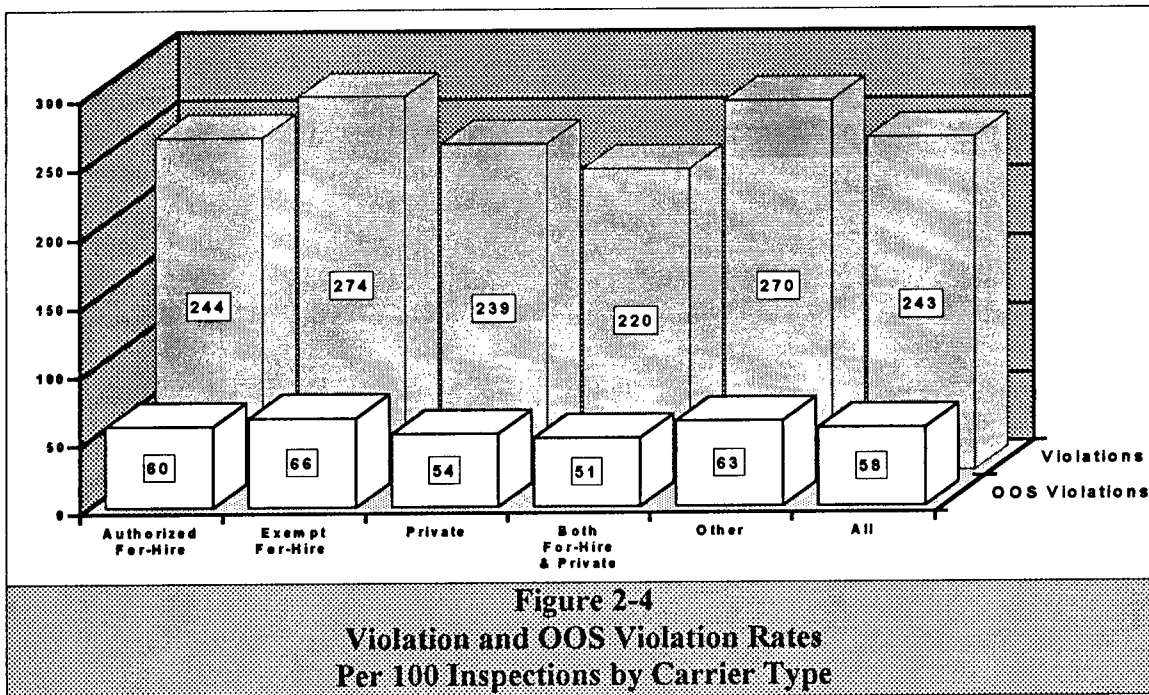
**Table 2-8**  
**Violation and OOS Violations**  
**By Carrier Type**

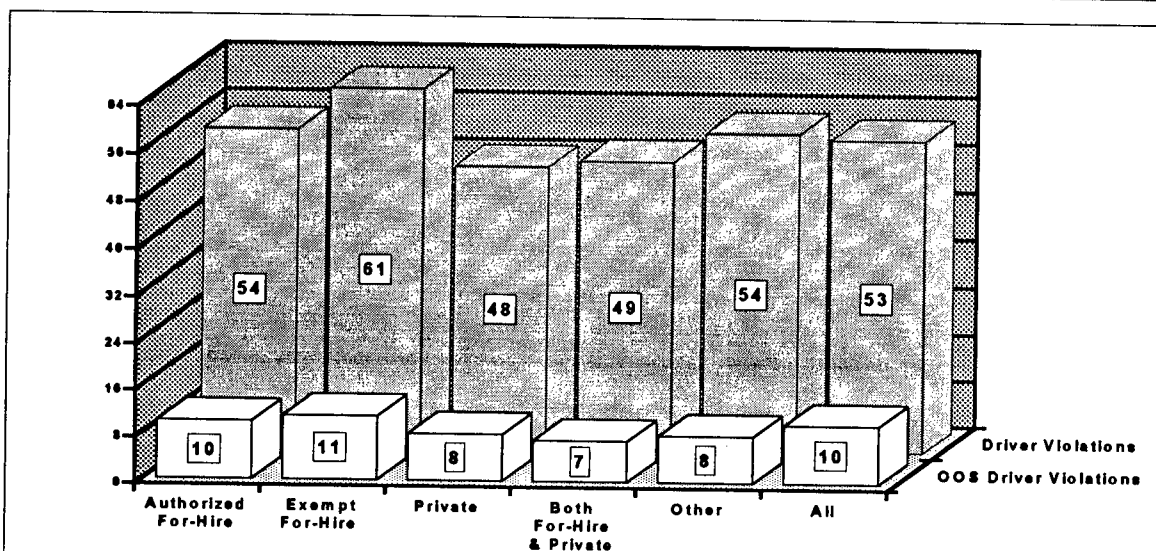
	Known Carriers			
	Violations		OOS Violations	
	Number	Percent	Number	Percent
For-Hire Authorized	1,941,512	70.6%	474,327	72.0%
For-Hire Exempt	94,713	3.4%	22,644	3.4%
Private	630,676	22.9%	142,421	21.6%
Both For-Hire & Private	59,589	2.2%	13,651	2.1%
Other	22,888	0.8%	5,374	0.8%
Total Violations	2,749,378	100.0%	658,417	100.0%

fleet size: 33 power units) (Figure 2-4). But the fleet-size pattern did not hold for private carriers (average fleet size: 13 power units), which had marginally fewer total violations—239 per 100 inspections—than authorized carriers. Indeed, private carriers performed as well as, or better than, authorized carriers on the inspection of vehicle and driver items

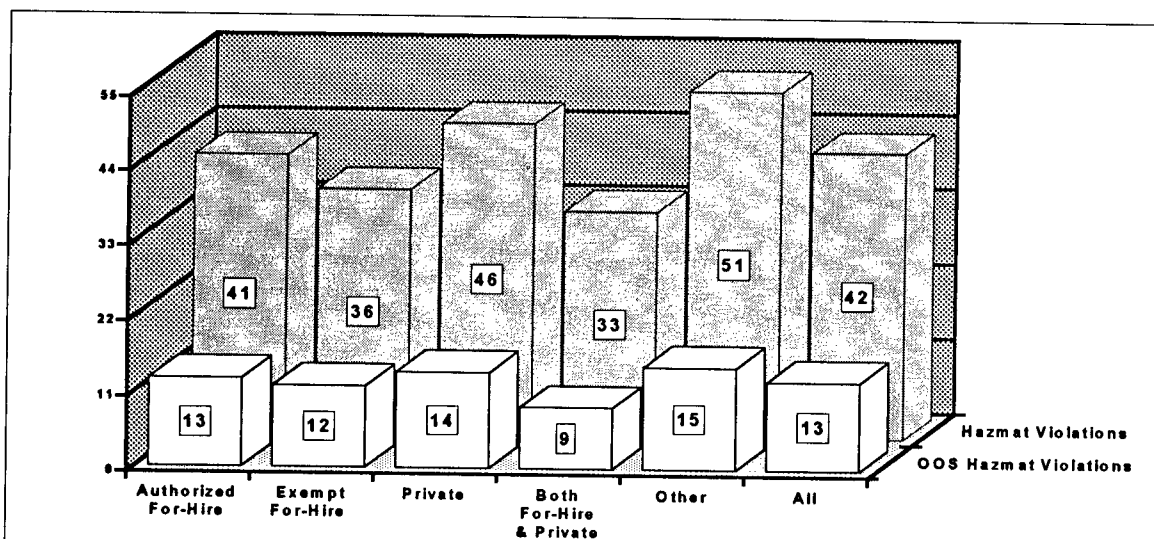
(Figures 2-5 and 2-6); private carriers did worse than authorized carriers only on inspection items pertaining to hazardous materials.

Interestingly, however, it was the group of carriers characterized as "both for-hire and private" (average fleet size: 17 vehicles) which





**Figure 2-6**  
**Driver Violation and OOS Violation Rates**  
**Per 100 Inspections by Carrier Type**



**Figure 2-7**  
**Hazardous Materials Violation and OOS Violation Rates**  
**Per 100 Hazardous Materials Inspections by Carrier Type**

performed consistently better than the other carrier types. The "both for-hire and private" group experienced 10 percent fewer violations—and 12 percent fewer OOS violations—than all the other carrier groups combined.

## FLEET SIZE

Carrier fleet size—measured as a count of total power units owned or operated—was discernible for more than one million 1992 inspections. As shown in Table 2-9, nearly one-half (49 percent) of all inspections in which fleet

size could be identified involved companies operating 38 power units or less. Nearly one-third (32 percent) of the inspections entailed carrier operation of 39 to 400 power

**Table 2-9**  
**Inspections By**  
**Fleet Size**

Fleet Size	Number	Percent
1 to 11	291,672	28.1%
12 to 38	211,808	20.4%
39 to 400	335,350	32.3%
401 to 2,000	128,562	12.4%
2,001 to 5,000	34,589	3.3%
Over 5,000	36,728	3.5%
Total	1,038,709	100.0%

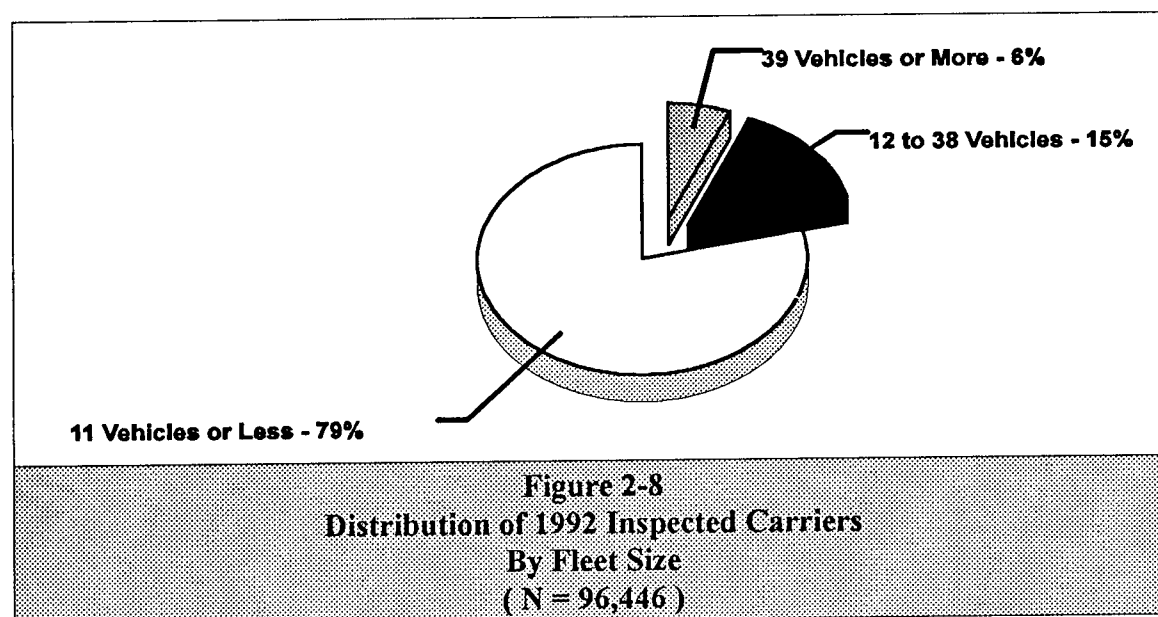
units. The remaining inspections (19 percent) involved carriers operating over 400 power units each.

Figure 2-8 offers a breakout of carriers inspected during the year where fleet size was known. The overwhelming majority of inspected carriers (79 percent) owned or operated 11 power units or less, while only 6 percent of the carriers operated 39 or more

units—fewer than 0.5 percent of the carriers operated more than 400 power units. Indeed, a precursory comparison of the information in Figure 2-8 and Table 2-9 brings to mind the types of patterns observed in the preceding section on carrier type—79 percent of the carriers inspected operated 11 vehicles or less, but only 28 percent of all inspections involved those carriers!

Table 2-10 helps sort through this issue by examining each fleet size category in terms of vehicle miles of travel. It may be seen, for example, that the smallest carriers (1-11 power units) travelled an average of 180,000 miles per year, whereas the largest companies (over 5,000 power units) each averaged more than 257 million miles per year. By taking account of the VMT, the expected fleet size frequencies could be calculated and compared to the actual (i.e., experienced) frequencies.

The analysis presented in Table 2-10 suggests that small carriers were over-represented in 1992 inspections and that large carriers were under-represented. This disparity was most pronounced for fleets of 1-11 power units, where nearly twice as many carriers were



**Table 2-10**  
**Inspection Frequencies By Fleet Size**  
**Expected vs. Experienced Values**

	Power Units						
	1 to 11	12 to 38	39 to 400	401 to 2,000	2,000 to 5,000	Over 5,000	Total
Carrier Representation in Population	79.29%	14.48%	5.79%	0.38%	0.04%	0.02%	100.00%
Mean VMT per Carrier (000)	180	1,198	6,429	45,474	157,487	257,442	
Proportional VMT (000)	143	173	372	173	64	51	976
Inspection Proportion - Expected	14.6%	17.7%	38.1%	17.7%	6.6%	5.2%	100.0%
Inspection Proportion - Experienced	28.1%	20.4%	32.3%	12.4%	3.3%	3.5%	100.0%

selected for inspection as was predicted by carrier representation on the nation's highways. The over-representation continued—though less dramatically—for fleets of 12-38 power units. On the other hand, carriers with fleets of 39 or more power units appeared to have been inspected somewhat less often than was predicted by their representation on the highways.

Table 2-11 shows violation and OOS violation counts by fleet size, and Figures 2-9 through 2-12 compare the violation and OOS violation rates. The data in the four figures suggest that there was a strong relationship between fleet size and inspection outcomes—namely, that as fleet size in-

creased, violation rates decreased. As revealed in Figure 2-9, for example, carriers operating fleets of 1-11 power units experienced, on average, 74 percent more violations than did carriers operating over 5,000 units (284 versus 163 violations per 100 inspections). This basic trend was observed for each of the defect groups—vehicle, driver, and hazardous materials—except that violation rates for vehicle and hazardous materials defects (Figures 2-10 and 2-12, respectively) were slightly higher for carriers operating 2,001-5,000 power units than carriers with 401-2,000 power units.

Figure 2-13 breaks carrier fleet size into three categories—small, medium, and large—and

**Table 2-11**  
**Violations and OOS Violations**  
**By Fleet Size**

Fleet Size	Violations	Percent	OOS Violations	Percent
1 to 11	827,135	33.0%	196,164	32.8%
12 to 38	541,197	21.6%	131,389	22.0%
39 to 400	761,746	30.5%	184,011	30.7%
401 to 2,000	243,894	9.8%	57,414	9.6%
2,001 to 5,000	66,807	2.7%	15,572	2.6%
Over 5,000	60,020	2.4%	14,050	2.3%
Total	2,500,799	100.0%	598,600	100.0%

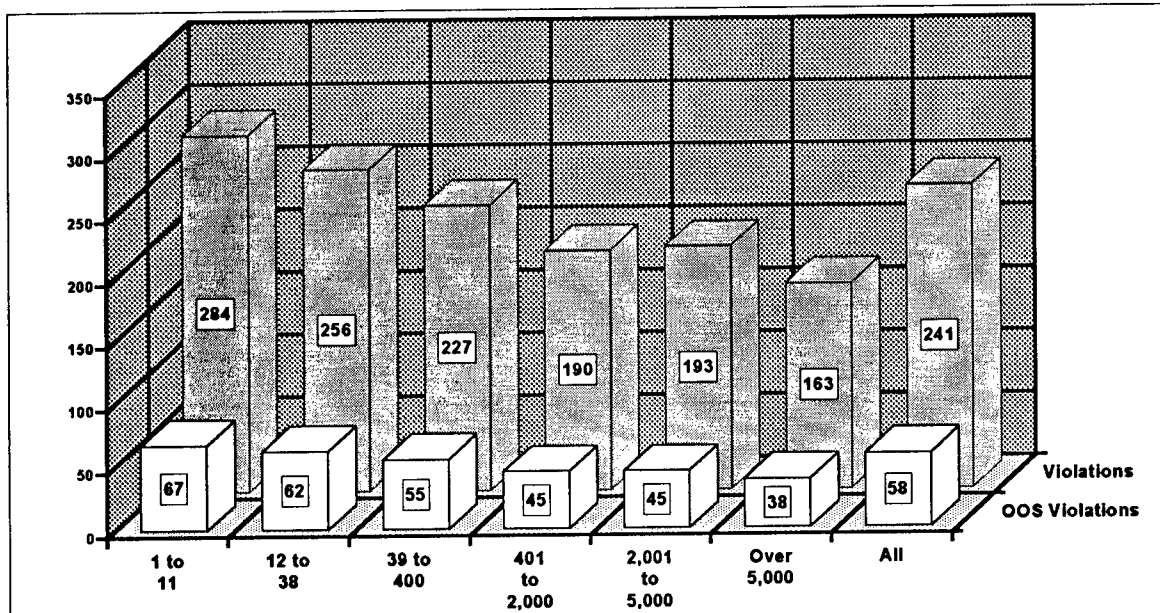


Figure 2-9  
Violation and OOS Violation Rates  
Per 100 Inspections by Fleet Size

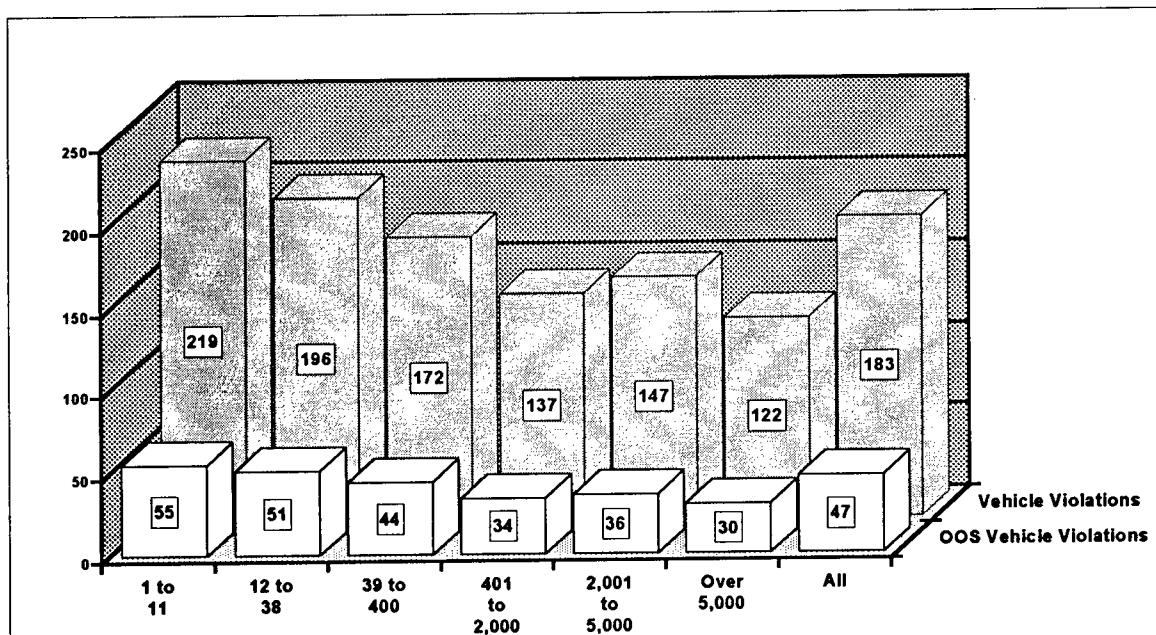
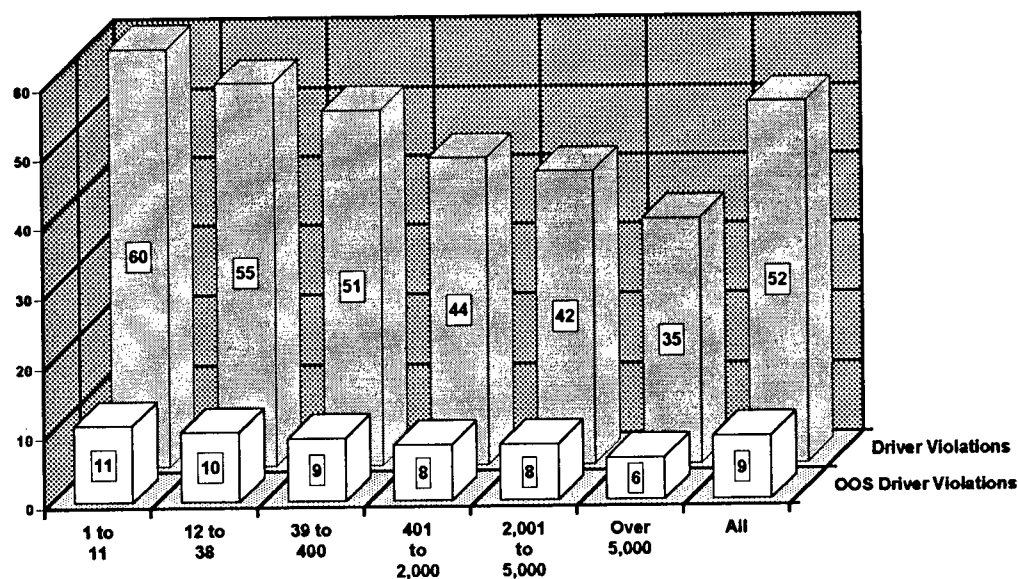
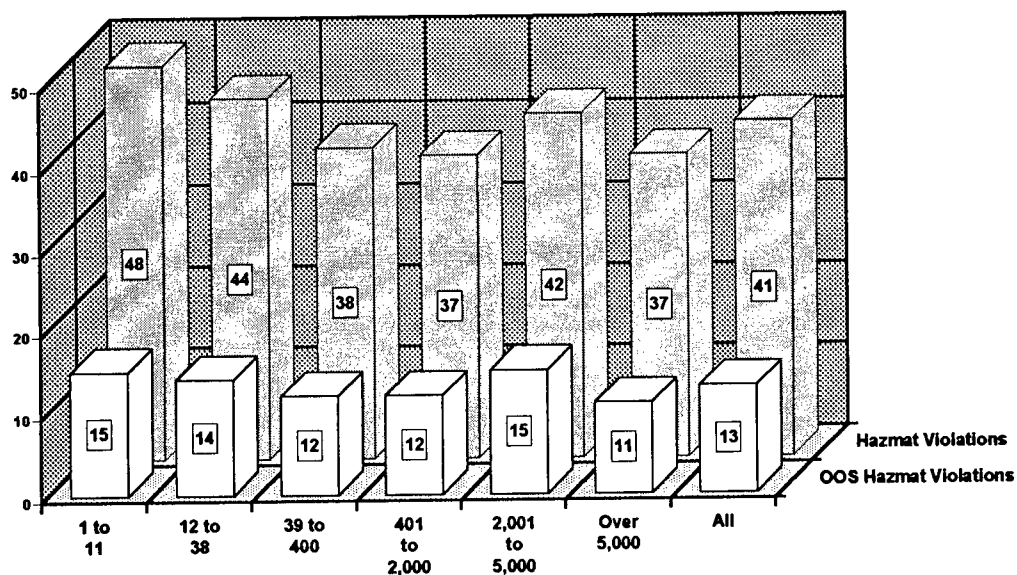


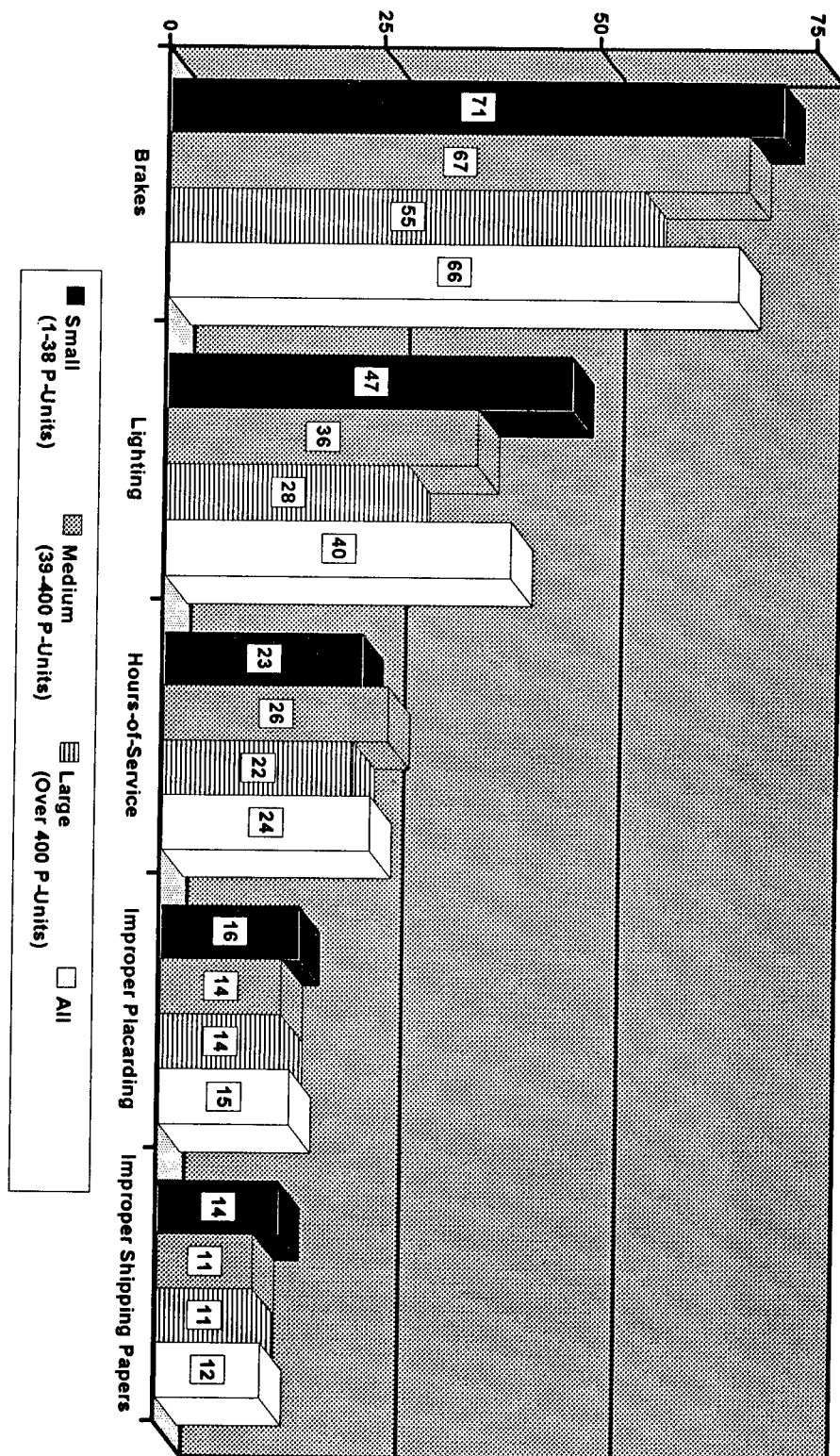
Figure 2-10  
Vehicle Violation and OOS Violation Rates  
Per 100 Inspections by Fleet Size



**Figure 2-11**  
Driver Violation and OOS Violation Rates  
Per 100 Inspections  
By Fleet Size



**Figure 2-12**  
Hazardous Materials Violation and OOS Violation Rates  
Per 100 Hazardous Materials Inspections  
By Fleet Size



**Figure 2-13**  
**Selected Defects by Fleet Size**  
**Violation Rates per 100 Inspections**

examines the corresponding violation rates for specific vehicle, driver, and hazardous materials defects. From this figure, it can be inferred that fleet size had a significant impact on the identification of brake and lighting violations, little or no impact on hour-of-service violations, and only marginal impact on violations resulting from improper placarding and improperly-prepared shipping papers. (Among the latter defects, the violation rates were higher for "small" carriers, but identical for "medium" and "large" carriers.) In other words, this display implies that while fleet size had a profound impact on overall inspection outcomes, the results were more mixed when individual defects were considered.

In summary, the data on fleet size support two conclusions: (1) smaller carriers were over-represented in 1992 inspections; and (2) the violation rates for smaller carriers were usually higher than the rates for larger carriers. These findings, taken together, suggest that over-representation of smaller carriers may actually have been desirable and, perhaps, even beneficial. Since comparatively more defects were discovered during inspections of vehicles from smaller fleets, the controlled "over-sampling" of small-fleet vehicles likely resulted in the removal of a larger number of unfit vehicles and drivers from the roadways than would have been the case without the over-representation.

## VEHICLE CONFIGURATION

Vehicle *configuration*—that is, arrangement of the individual units (tractors, trailers, etc.) comprising a given vehicle—is identified at the outset of each inspection. In this report, the various configurations are grouped into seven common categories, as follows:

*Tractor-Only.* A self-propelled commercial

truck-tractor with no additional unit, such as a trailer or other cargo box, attached. Normally, a vehicle in this configuration has already delivered its load and is returning to the point of origin for new assignments.

*Straight Truck.* A commercial vehicle in which the power unit and cargo box are non-detachable.

*Tractor-Trailer/Single.* A commercial vehicle consisting of a truck-tractor and detachable trailer. Normally, the trailer in this configuration is a "semi-trailer."

*Tractor-Trailer/Double.* A commercial vehicle consisting of a truck-tractor and two detachable trailers. Normally, the first trailer is a semi-trailer and the second is a "full trailer." (A semi-trailer can be made to function as a full trailer using a device called a "dolly converter.")

*Tractor-Trailer/Triple.* A commercial vehicle consisting of a truck-tractor and three detachable trailers. Normally, the first trailer is a semi-trailer and the second and third are full trailers.

*Bus.* A commercial vehicle designed and used to transport passengers.

*Other.* A commercial vehicle which does not fit any of the configurations described above. Examples include a tow vehicle pulling a commercial vehicle, a truck-tractor "piggy-backed" on another truck-tractor, two buses attached, etc. This category also includes "unknown" configurations which could not be definitively identified after the inspection was completed.

The vehicle configurations described above are graphically depicted in the Appendix.

As shown in Table 2-12, the vast majority of vehicles (75 percent) inspected in 1992 were

**Table 2-12**  
**Inspections by**  
**Vehicle Configuration**

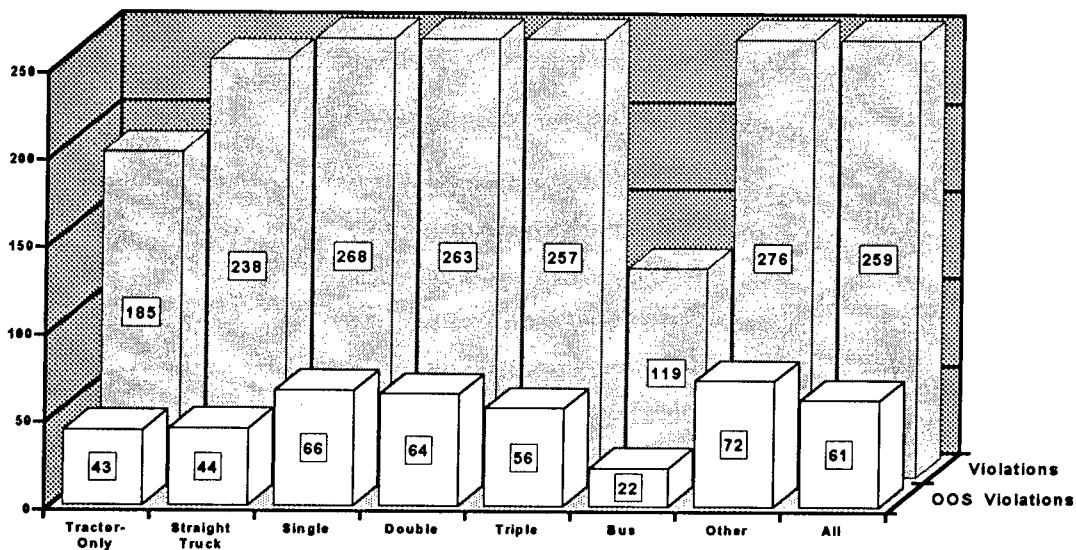
Configuration Type	Number	Percent
Tractor-Only	46,039	3.2%
Straight Truck	245,244	16.9%
Tractor-Trailer/Single	1,086,288	75.0%
Tractor-Trailer/Double	25,502	1.8%
Tractor-Trailer/Triple	495	0.0%
Bus	11,976	0.8%
Other	33,682	2.3%
Total	1,449,226	100.0%

tractor-trailers/singles. This was followed by straight trucks at 17 percent. Less than 2 percent of all inspections involved doubles or triples, and under one percent involved buses.

Table 2-13 identifies violation and OOS violation counts by vehicle configuration; Figures 2-14 through 2-17 compare the violation and OOS violation rates. In general, the vehicle

**Table 2-13**  
**Violations and OOS Violations**  
**By Vehicle Configuration**

Configuration Type	Violations		OOS Violations	
	Number	Percent	Number	Percent
Tractor-Only	84,963	2.3%	19,842	2.2%
Straight Truck	582,722	15.5%	107,716	12.1%
Tractor-Trailer/Single	2,906,613	77.5%	718,895	80.8%
Tractor-Trailer/Double	67,065	1.8%	16,412	1.8%
Tractor-Trailer/Triple	1,272	0.0%	279	0.0%
Bus	14,271	0.4%	2,657	0.3%
Other	93,004	2.5%	24,291	2.7%
Total	3,749,910	100.0%	890,092	100.0%

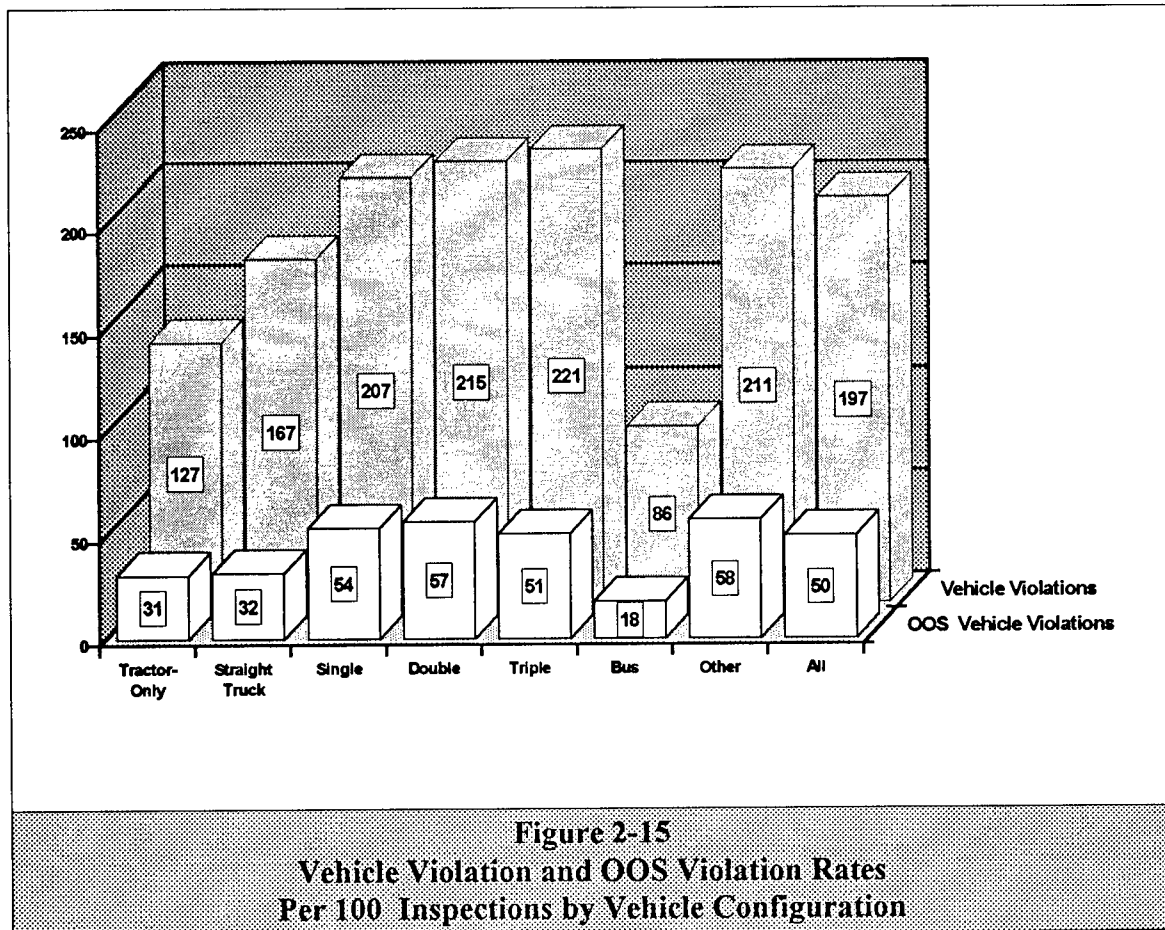


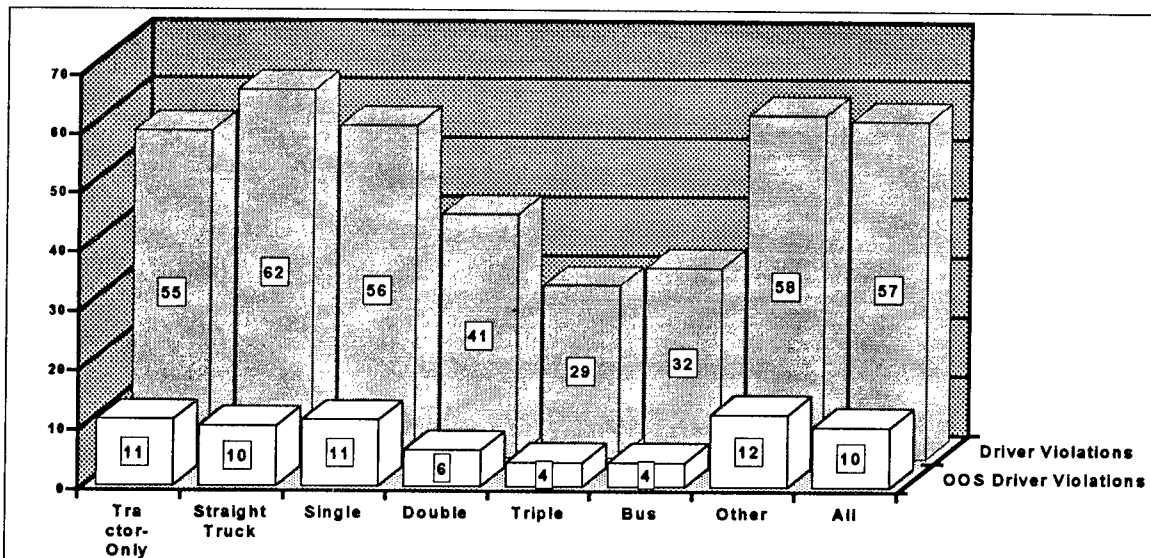
**Figure 2-14**  
**Violation and OOS Violation Rates**  
**Per 100 Inspections by Vehicle Configuration**

violation rates tended to increase as configuration lengths increased (Figure 2-15). For instance, among the property-carrying vehicles, tractors-only had the lowest vehicle violation rate (127 per 100 inspections), followed by straight trucks (167), singles (207), doubles (215), and triples (221), respectively. (Among all vehicles—both property- and passenger-carrying—buses had the lowest violation rate overall: 86 per 100 inspections.) However, while the rate differential between tractors-only, straight trucks, and singles was significant, the rate difference between singles, doubles, and triples was modest. Furthermore, the pattern did not fare as well when OOS vehicle violation rates were considered: tractors-only had an OOS rate nearly identical to straight trucks (31 vs. 32 OOS violations per 100

inspections), and the OOS rate for triples was, in fact, slightly lower than that for singles (51 vs. 54).

Whereas vehicle violation rates tended to *increase* with configuration length, driver violation rates appeared to *decrease* with length (Figure 2-16). For example, the driver violation rates for straight trucks, singles, doubles, and triples were 62, 56, 41, and 29, respectively. Although information on professional driving experience was not normally collected during inspections, the patterns observed here may well be explained by common suppositions about driver assignments—namely, that the drivers assigned to extremely large vehicles (i.e., doubles and triples) have more experience and better safety records than the professional driver population at-large.



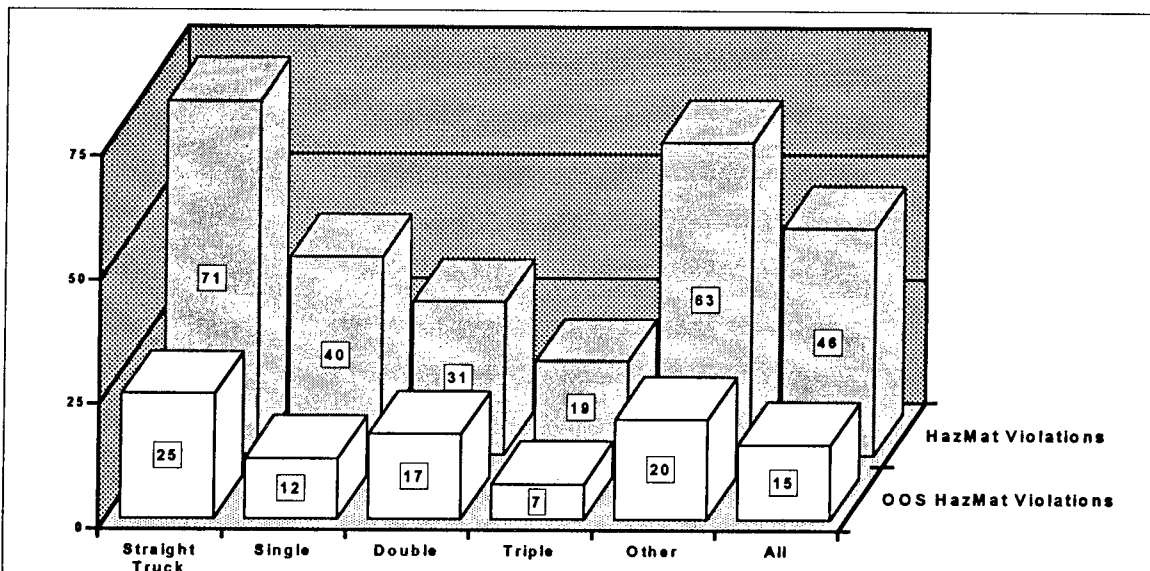


**Figure 2-16**  
Driver Violation and OOS Violation Rates  
Per 100 Inspections by Vehicle Configuration

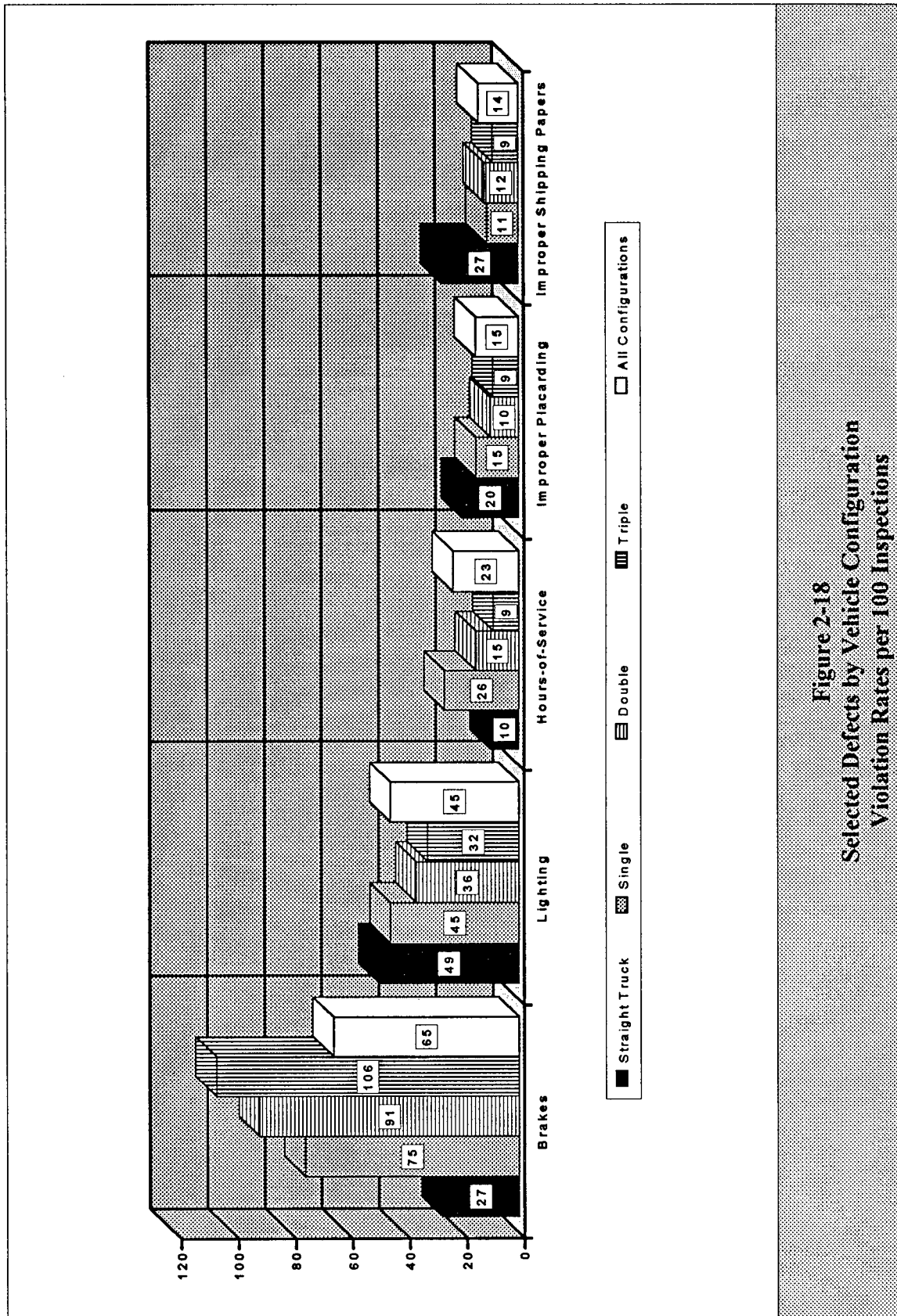
An inverse relationship also appeared to exist between configuration length and incidence of hazardous materials violations (Figure 2-17). However, an anomaly showed up in the pattern when the OOS violation rate was examined—the rate went

from 25 OOS violations per 100 hazardous materials inspections for straight trucks, down to 12 OOS violations for singles, but back up to 17 OOS violations for doubles.

Figure 2-18 reveals that even the most basic



**Figure 2-17**  
Hazardous Materials Violation and OOS Violation Rates  
Per 100 Hazardous Materials Inspections by Vehicle Configuration



patterns, identified above, can be elusive when individual defects are considered. For example, the rate of brake violations *increased* as vehicle configuration lengthened, at the same time that the rate of lighting defects *decreased*. Similarly, the rate of hours-of-service violations conformed with the driver pattern generally—decreasing as configuration length increased—provided that only singles, doubles, and triples were considered. However, when straight trucks were taken into account, the pattern looked quite different—the rate of hours-of-service violations for straight trucks (10 per 100 inspections) was nearly as low as that for triples (9), and much lower than that for singles and doubles (26 and 15, respectively).

## HAZARDOUS MATERIALS

What was the relationship between the presence or non-presence of hazardous materials and inspection outcomes? To examine this question, the violation rates for vehicles transporting hazardous materials at the time of the inspection were compared to the rates for vehicles transporting non-hazardous materials only. The focus of the examination was on overall violation rates, and then on vehicle and driver violation rates. Comparisons of rates for hazardous material violations, of course, could not be made between the two sets of inspections.

Approximately 10 percent of all vehicles in-

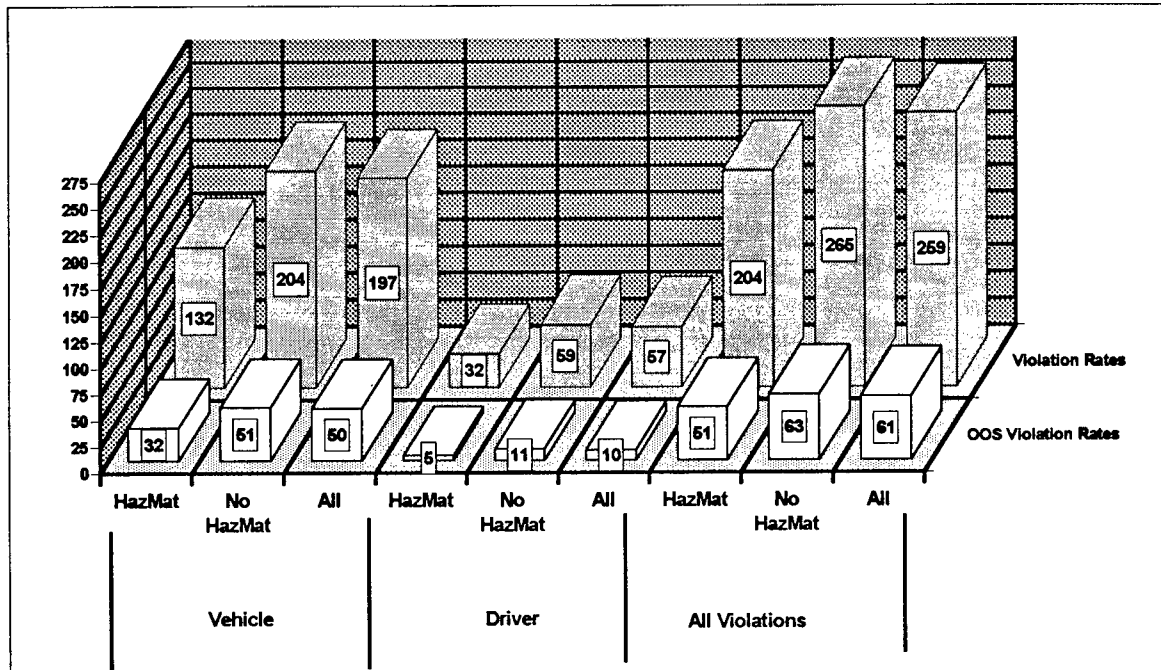
spected in 1992 were transporting hazardous materials at the time of the inspection (Table 2-14). As shown in Figure 2-19, the overall violation rate when hazardous materials were onboard was 204 per 100 inspections versus 265 per 100 inspections when only non-hazardous materials were onboard. The vehicle violation rate was 132 for hazardous materials versus 204 for non-hazardous materials, and the driver violation rate was 32 for hazardous materials versus 59 for non-hazardous materials. Similar trends were apparent when OOS violation rates were compared.

Figure 2-20 compares violation rates for selected defects. Inspections where hazardous materials were present at the time of the inspection experienced, on average, 22 percent fewer brake violations, 43 percent fewer lighting violations, and 54 percent fewer hours-of-service violations than inspections where only non-hazardous materials were present.

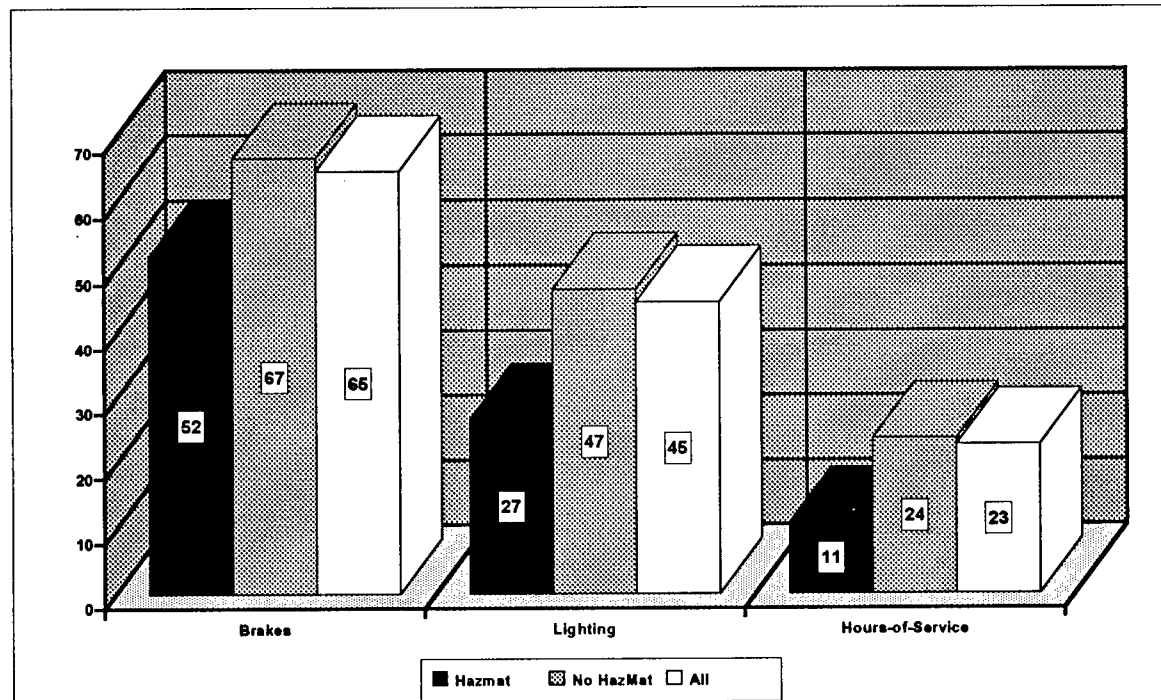
In general, this assessment lends credence to the thesis that vehicles and drivers transporting hazardous materials tended to comply more fully with State and Federal safety regulations than vehicles and drivers transporting non-hazardous materials only. It should be noted, however, that this comparison applies only to individual inspections, and does not address the relative safety fitness of *carriers* of hazardous versus non-hazardous materials.

**Table 2-14**  
**Inspection and Violation Counts**  
**By Presence of Hazardous Materials**

	Hazardous Materials Onboard Vehicle		Non-Hazardous Materials Only Onboard Vehicle		Total	
	Number	Percent	Number	Percent	Number	Percent
<b>Inspections</b>	138,839	9.6%	1,310,387	90.4%	1,449,226	100.0%
<b>Violations</b>	282,866	7.5%	3,467,044	92.5%	3,749,910	100.0%
<b>OOS Violations</b>	70,132	7.9%	819,960	92.1%	890,092	100.0%



**Figure 2-19**  
Vehicle/Driver Violation and OOS Violation Rates  
Per 100 Inspections by Presence of Hazardous Materials



**Figure 2-20**  
Selected Defects by Presence of Hazardous Materials  
Violation Rates per 100 Inspections



## CHAPTER 3

### *The Impact of the Inspection Environment*

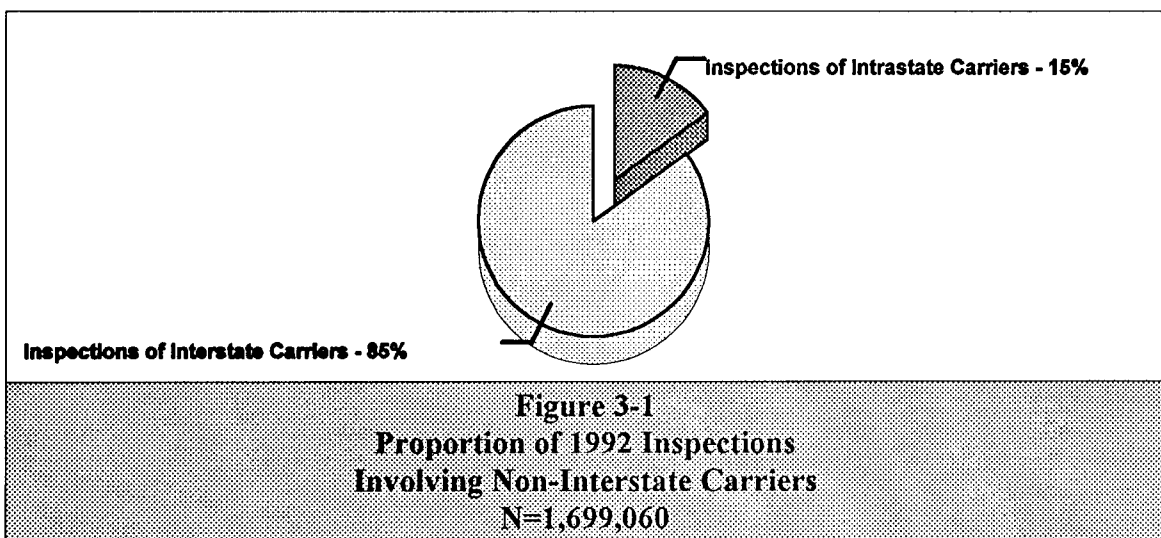
Location  
Facility  
Season  
Time-of-Day  
Duration

Most States and U.S. territories participated in the 1992 national inspection program. States exercised generally broad discretion over how best to structure and prioritize their individual programs. Inspections were variously conducted at *fixed* and *mobile* facilities; inspections at fixed facilities tended to result in higher vehicle violation rates, while inspections at mobile facilities had slightly higher driver and hazardous materials violation rates. More inspections were performed in warmer weather than colder weather; warmer-weather inspections resulted in higher violation rates. Eighty percent of all inspections were conducted between 6AM and 6PM, with the heaviest concentration of activities occurring before noon; daytime inspections produced higher

violation rates than did nighttime inspections. The average inspection was 31 minutes in length; longer inspections resulted in more violations; and Full Inspections, of all the inspection methodologies, produced the highest violation rates per hour of inspection activity.

#### LOCATION

Eighty-five percent of all inspections conducted in 1992 involved interstate carriers (Figure 3-1). Nearly all of these inspections were performed by State personnel—a statistically insignificant proportion of the interstate inspections (0.1 percent) were performed by Federal safety investiga-



tors.

Tables 3-1 through 3-4 summarize 1992 interstate inspection activity by State location. In reviewing these data, the following factors should be taken into account:

- The data *do not* reflect the 249,834 inspections of intrastate carriers completed in 1992. The data *do*, however, include the 1,731 inspections performed by Federal investigators.
- Several States and territories *did not* participate in MCSAP in 1992: Florida, South Dakota, Northern Marianas, and the Virgin Islands. The 27 inspections of interstate carriers reported in South Dakota were performed by Federal personnel.
- None of the inspections completed by the following States and Territories, which *did* participate in MCSAP in 1992, appeared to involve interstate carriers: Hawaii, American Samoa, and Puerto Rico. One inspection performed in Guam reportedly involved an interstate carrier.

Data in the tables for individual States may be compared to the totals for all States to determine State standings against the national norms. For instance, Table 3-2 supports the comparison of violation rates, OOS violation rates, and violation-to-OOS violation ratios. (Remember that lower ratios mean that higher percentages of violations resulted in out-of-service citations.)

Table 3-4 identifies the percentage of in-

spections in each State which were Full Inspections, and the mean duration of Full Inspections when they were conducted. By studying these tables, much can be learned about individual States' 1992 inspection activities. For example, State-by-State comparisons reveal that higher percentages of Full Inspections (Table 3-4) were associated with lower counts of total inspections (Table 3-1), but higher violation rates per inspection (Tables 3-2 and 3-3). Even among those States which conducted comparable percentages of Full Inspections (Table 3-4), longer inspection durations correlated positively with higher violation rates (Tables 3-2 and 3-3). The States, clearly, had different perspectives on whether to perform (1) less comprehensive inspections on a larger volume of vehicles, or (2) more comprehensive inspections on fewer vehicles.

## FACILITY

Most inspections, in 1992, were conducted at either *fixed* or *mobile* facilities. "Fixed" facilities included scales and other permanent inspection sites. "Mobile" or "roadside" facilities were those which could be easily relocated to different places, as conditions warranted. For example, a mobile inspection facility might be temporarily established along a secondary road near a junction with an interstate highway.

As revealed in Figure 3-2, the largest volume of inspections (42 percent) were conducted at fixed facilities, while 30 percent were performed at mobile facilities. "Unknown" (28 percent) referred both to (1) facilities which could not be characterized

**Table 3-1**  
**Inspection, Violation, and OOS Violation Counts**  
**By State**

	Number of Inspections	Number of Violations	Number of OOS Violations
Alabama	13,712	50,470	9,846
Alaska	533	1,655	609
American Samoa	0	0	0
Arizona	24,084	111,073	17,302
Arkansas	37,330	88,107	24,737
California	123,725	173,684	46,939
Colorado	19,712	50,226	11,692
Connecticut	19,808	51,825	12,347
Delaware	5,021	11,957	4,132
Dist. of Columbia	4,637	8,027	888
Florida	0	0	0
Georgia	25,036	51,376	16,748
Guam	1	8	1
Hawaii	0	0	0
Idaho	7,727	25,457	4,694
Illinois	79,299	136,314	21,759
Indiana	56,778	163,926	30,563
Iowa	33,607	67,239	14,621
Kansas	16,411	35,413	9,277
Kentucky	81,656	195,590	58,257
Louisiana	31,177	104,784	18,596
Maine	5,511	19,674	7,602
Maryland	60,284	127,215	23,822
Massachusetts	23,101	48,132	8,518
Michigan	30,505	126,413	22,631
Minnesota	7,856	22,630	3,631
Mississippi	24,036	53,601	15,107
Missouri	65,912	287,832	69,382
Montana	20,100	31,180	6,889
Nebraska	24,927	34,088	11,216
Nevada	8,977	22,947	6,020
New Hampshire	11,577	30,291	5,680
New Jersey	24,341	77,003	10,616
New Mexico	15,452	38,717	12,961
New York	45,822	109,171	41,111
North Carolina	60,902	118,183	26,681
North Dakota	10,076	16,716	3,642
Northern Marianas	0	0	0
Ohio	65,793	241,126	72,151
Oklahoma	11,385	23,781	5,752
Oregon	16,964	38,321	8,076
Pennsylvania	66,348	231,299	42,060
Puerto Rico	0	0	0
Rhode Island	6,685	24,640	4,678
South Carolina	23,230	56,595	15,973
South Dakota	27	4	0
Tennessee	44,348	144,485	47,797
Texas	46,300	160,999	26,015
Utah	18,438	61,968	10,254
Vermont	6,848	19,728	3,055
Virginia	32,342	78,407	22,224
Virgin Islands	0	0	0
Washington	49,202	94,940	29,471
West Virginia	12,775	13,941	5,947
Wisconsin	19,210	42,958	13,575
Wyoming	9,698	25,794	4,547
All States	1,449,226	3,749,910	890,092

**Table 3-2**  
**Violation Rates per 100 Inspections and**  
**Ratio of Total Violations to OOS Violations**

	Violation Rate	OOS Violation Rate	Ratio of Violations to OOS Violations
Alabama	368	72	5.1
Alaska	311	114	2.7
American Samoa	NA	NA	NA
Arizona	461	72	6.4
Arkansas	236	66	3.6
California	140	38	3.7
Colorado	255	59	4.3
Connecticut	262	62	4.2
Delaware	238	82	2.9
Dist. of Columbia	173	19	9
Florida	NA	NA	NA
Georgia	205	67	3.1
Guam	NA	NA	NA
Hawaii	NA	NA	NA
Idaho	329	61	5.4
Illinois	172	27	6.3
Indiana	289	54	5.4
Iowa	200	44	4.6
Kansas	216	57	3.8
Kentucky	240	71	3.4
Louisiana	336	60	5.6
Maine	357	138	2.6
Maryland	211	40	5.3
Massachusetts	208	37	5.7
Michigan	414	74	5.6
Minnesota	288	46	6.2
Mississippi	223	63	3.5
Missouri	437	105	4.1
Montana	155	34	4.5
Nebraska	137	45	3
Nevada	256	67	3.8
New Hampshire	262	49	5.3
New Jersey	316	44	7.3
New Mexico	251	84	3
New York	238	90	2.7
North Carolina	194	44	4.4
North Dakota	166	36	4.6
Northern Marianas	NA	NA	NA
Ohio	366	110	3.3
Oklahoma	209	51	4.1
Oregon	226	48	4.7
Pennsylvania	349	63	5.5
Puerto Rico	NA	NA	NA
Rhode Island	369	70	5.3
South Carolina	244	69	3.5
South Dakota	NA	NA	NA
Tennessee	326	108	3
Texas	348	56	6.2
Utah	336	56	6
Vermont	288	45	6.5
Virginia	242	69	3.5
Virgin Islands	NA	NA	NA
Washington	193	60	3.2
West Virginia	109	47	2.3
Wisconsin	224	71	3.2
Wyoming	266	47	5.7
All States	259	61	4.2

**Table 3-3**  
**Vehicle, Driver, and Hazardous Materials**  
**Violation and OOS Violation Rates**  
**Per 100 Inspections**

	Vehicle		Driver		Hazmat	
	Violation Rate	OOS Rate	Violation Rate	OOS Rate	Violation Rate	OOS Rate
Alabama	283	54	100	16	55	21
Alaska	240	95	53	11	132	55
American Samoa	NA	NA	NA	NA	NA	NA
Arizona	286	51	171	20	88	18
Arkansas	177	49	57	17	20	8
California	119	34	20	4	30	4
Colorado	197	48	54	10	38	15
Connecticut	206	49	48	10	77	36
Delaware	173	66	60	15	97	27
Dist. of Columbia	147	18	25	1	30	8
Florida	NA	NA	NA	NA	NA	NA
Georgia	150	52	42	11	86	21
Guam	NA	NA	NA	NA	NA	NA
Hawaii	NA	NA	NA	NA	NA	NA
Idaho	225	43	91	15	103	24
Illinois	75	19	86	8	49	3
Indiana	219	48	68	6	30	8
Iowa	154	35	43	8	65	17
Kansas	156	44	58	11	24	16
Kentucky	215	61	23	10	17	9
Louisiana	241	46	88	12	49	11
Maine	324	121	30	15	36	18
Maryland	170	33	39	6	29	9
Massachusetts	118	29	88	7	42	9
Michigan	348	67	66	7	6	1
Minnesota	166	31	121	14	9	3
Mississippi	173	50	46	11	36	17
Missouri	371	89	60	15	94	28
Montana	110	26	44	8	23	4
Nebraska	98	27	37	18	20	10
Nevada	195	52	53	14	35	8
New Hampshire	162	41	97	7	45	11
New Jersey	188	34	124	8	42	14
New Mexico	215	69	33	14	33	10
New York	177	76	53	9	74	42
North Carolina	155	34	37	9	20	8
North Dakota	113	28	51	8	18	5
Northern Marianas	NA	NA	NA	NA	NA	NA
Ohio	301	89	49	13	115	55
Oklahoma	145	36	53	9	43	19
Oregon	177	39	48	8	1	0
Pennsylvania	289	53	75	9	75	19
Puerto Rico	NA	NA	NA	NA	NA	NA
Rhode Island	252	47	109	18	66	46
South Carolina	201	57	36	9	55	26
South Dakota	NA	NA	NA	NA	NA	NA
Tennessee	261	90	44	16	74	22
Texas	224	34	121	21	60	18
Utah	277	49	57	6	40	14
Vermont	196	33	86	11	94	11
Virginia	202	59	38	9	32	12
Virgin Islands	NA	NA	NA	NA	NA	NA
Washington	165	51	26	8	25	11
West Virginia	87	36	22	11	21	7
Wisconsin	162	48	59	22	49	14
Wyoming	124	27	133	17	106	24
All States	197	50	57	10	46	15

**Table 3-4**  
**Percent Full Inspections**  
**And Mean Inspection Durations**  
**By State**

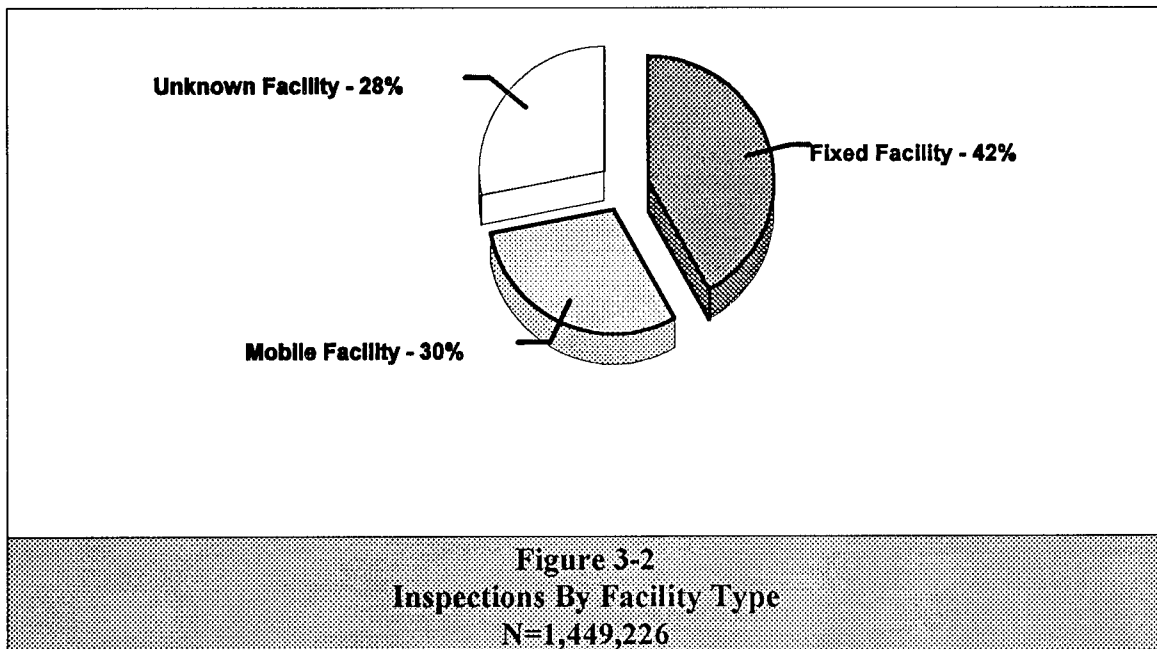
	Percent of Full Inspections	Mean Duration of Full Inspection (in minutes)
Alabama	35 %	22
Alaska	75 %	44
American Samoa	0 %	NA
Arizona	45 %	43
Arkansas	52 %	35
California	96 %	21
Colorado	55 %	24
Connecticut	56 %	39
Delaware	70 %	24
Dist. of Columbia	72 %	21
Florida	0 %	NA
Georgia	53 %	32
Guam	100 %	20
Hawaii	0 %	NA
Idaho	53 %	32
Illinois	18 %	37
Indiana	57 %	46
Iowa	41 %	43
Kansas	70 %	22
Kentucky	92 %	33
Louisiana	75 %	23
Maine	84 %	24
Maryland	34 %	26
Massachusetts	52 %	48
Michigan	92 %	43
Minnesota	36 %	36
Mississippi	74 %	38
Missouri	54 %	45
Montana	49 %	37
Nebraska	32 %	33
Nevada	34 %	33
New Hampshire	70 %	34
New Jersey	57 %	42
New Mexico	56 %	34
New York	95 %	24
North Carolina	39 %	31
North Dakota	48 %	24
No. Marianas	0 %	NA
Ohio	55 %	44
Oklahoma	32 %	29
Oregon	56 %	22
Pennsylvania	62 %	49
Puerto Rico	0 %	NA
Rhode Island	67 %	28
South Carolina	69 %	39
South Dakota	0 %	NA
Tennessee	77 %	37
Texas	18 %	35
Utah	68 %	36
Vermont	77 %	44
Virginia	68 %	30
Virgin Island	0 %	NA
Washington	44 %	29
West Virginia	39 %	24
Wisconsin	41 %	34
Wyoming	32 %	46
All States	58 %	33

either as fixed or mobile, and (2) facilities which were not identified at all. Because the "unknown" category was relatively large, most observations about facility type must be viewed, at best, as tentative.

Tables 3-5 and 3-6 summarize inspection activity by facility type. As shown in the latter table, 67 percent of all inspections at fixed facilities were Full Inspections, as compared to only 47 percent at mobile facilities. The reverse was true for Walk-Around Inspections—22 percent of all inspections at fixed facilities were Walk-Arounds, as compared to 38 percent at mobile facilities. In other words, although Full Inspections pre-

dominated at both types of facilities, Walk-Arounds were performed with greater frequency at mobile inspection sites than at fixed facilities.

Figures 3-3 through 3-6 compare violation rates by facility type. The overall violation rates for fixed and mobile sites were nearly identical—235 versus 239 violations, respectively, per 100 inspections (Figure 3-3). However, examination of individual vehicle, driver, and hazardous materials violation rates by facility type reveals significant differences. For instance, the vehicle violation rate was 12 percent higher at fixed, as opposed to mobile, facilities (Figure 3-4). In contrast, the driver



**Table 3-5**  
Inspection and Violation Counts  
By Facility Type

	Fixed		Mobile		Other/Unknown		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Inspections	606,331	41.8%	437,199	30.2%	405,696	28.0%	1,449,226	100.0%
Violations	1,426,575	38.0%	1,044,451	27.9%	1,278,884	34.1%	3,749,910	100.0%
OOS Violations	355,053	39.9%	227,347	25.5%	307,692	34.6%	890,092	100.0%

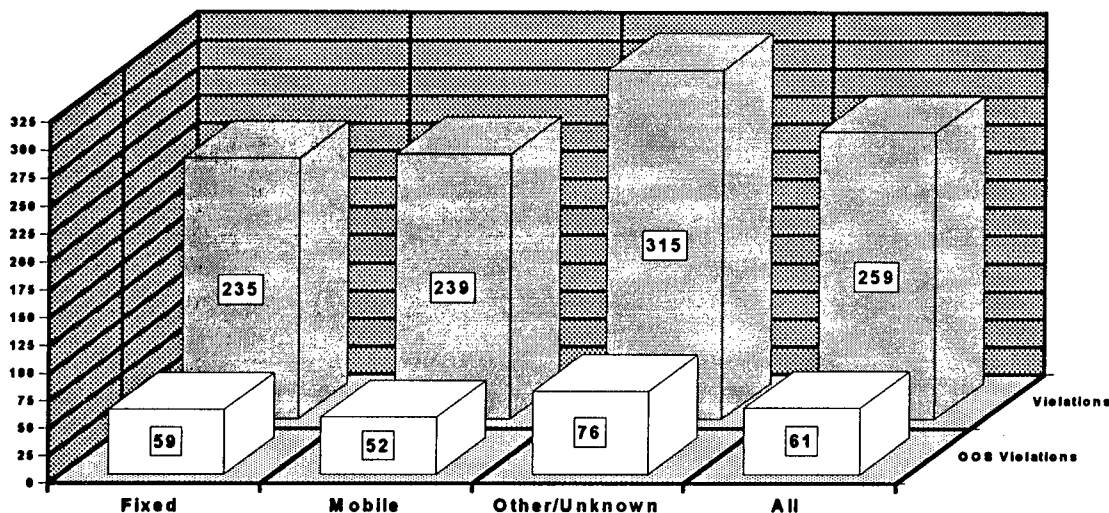
**Table 3-6**  
**Proportion of Inspections**  
**By Facility Type and Inspection Level**

	Fixed	Mobile	Other/ Unknown	All
Full	66.6 %	46.7 %	58.7 %	58.4 %
Walk-Around	21.8 %	38.4 %	32.2 %	29.7 %
Driver-Only	10.4 %	13.1 %	7.2 %	10.3 %
Terminal	0.4 %	0.4 %	1.4 %	0.7 %
Special	0.7 %	1.5 %	0.4 %	0.9 %
Total Inspections	606,331	437,199	405,696	1,449,226

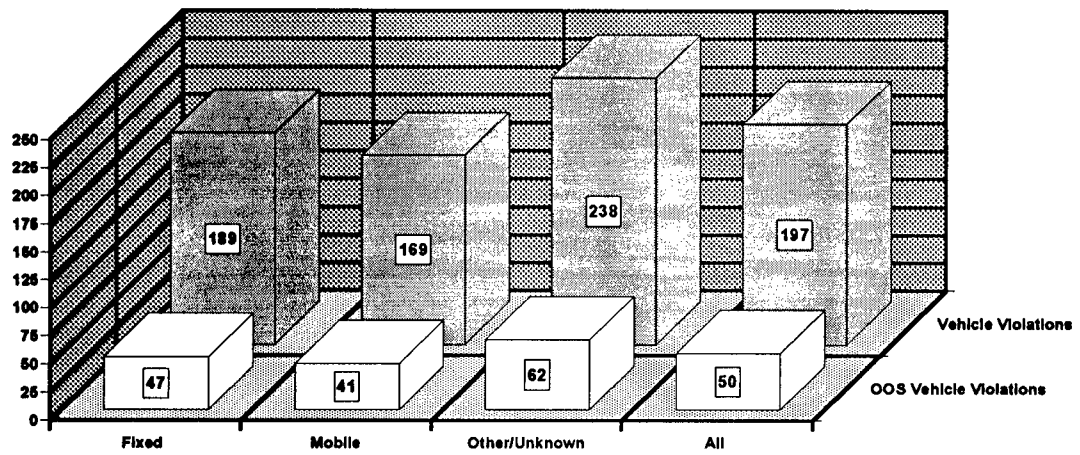
violation rate was 49 percent higher—and the hazardous materials violation rate was 29 percent higher—at mobile facilities than at fixed facilities (Figures 3-5 and 3-6). Of course, some of these differences can be explained by the inspection levels which predominated among the two facility types. For example, as previously observed, Full Inspections appeared to best identify *vehicle* violations, whereas Walk-Arounds and Driver-Only Inspections most aptly identified *driver* violations. It is unlikely that the differences in violation rates between the facility types, however, can be totally explained by inspection level, since inspections at both types of facilities involved a mix of inspection levels.

After all, more Full Inspections than Walk-Arounds were performed using mobile facilities, and yet the driver violation rate at mobile facilities was considerably higher than at fixed facilities.

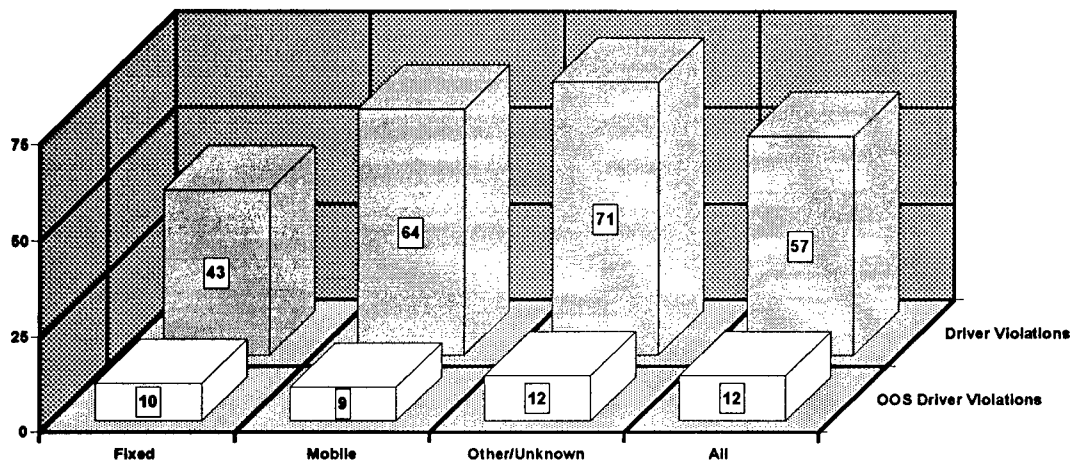
Interestingly, the OOS violation rates by facility type tended not to mirror violation rates generally. For instance, Figure 3-5 shows that although the driver violation rate at mobile facilities was markedly higher than at fixed facilities (64 versus 43 violations per 100 inspections), the OOS rate for drivers was, in fact, highest at fixed facilities (10 versus 9). Overall, the ratio of violations-to-OOS violations was lowest at fixed facilities.



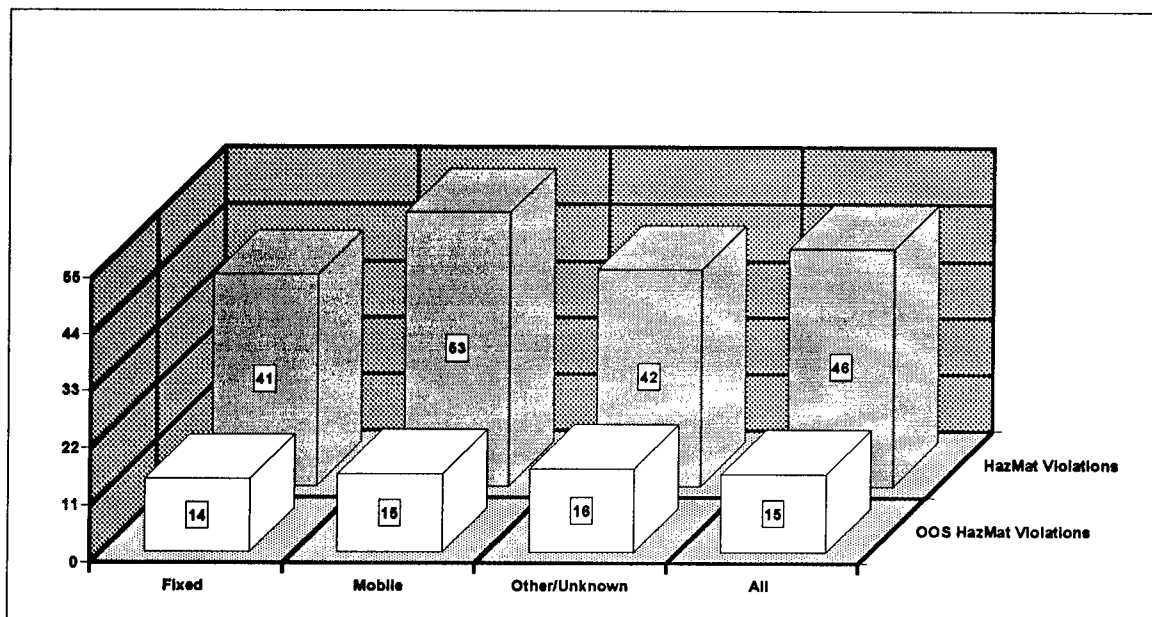
**Figure 3-3**  
**Violation and OOS Violation Rates**  
**Per 100 Inspections by Facility Type**  
**N=1,449,226**



**Figure 3-4**  
**Vehicle Violation and OOS Violation Rates**  
**Per 100 Inspections by Facility Type**  
**N=1,449,226**



**Figure 3-5**  
**Driver Violation and OOS Violation Rates**  
**Per 100 Inspections by Facility Type**  
**N=1,449,226**

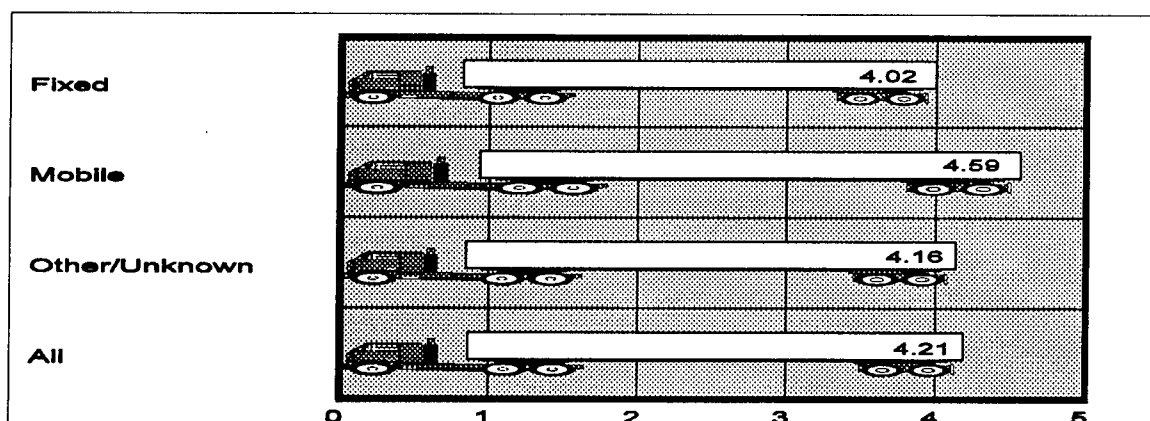


**Figure 3-6**  
**Hazardous Materials Violation and OOS Violation Rates**  
**Per 100 Hazardous Materials Inspections by Facility Type**  
**N=138,768**

ties(Figure 3-7).

Figures 3-8 through 3-10 examine selected defects by facility type. Whereas brake violations were most likely to be identified, as expected, at fixed facilities, the identification of lighting violations

tended to predominate at mobile facilities (Figure 3-8). Also, fixed facilities were marginally more likely than mobile facilities to identify hours-of-service violations (Figure 3-9).

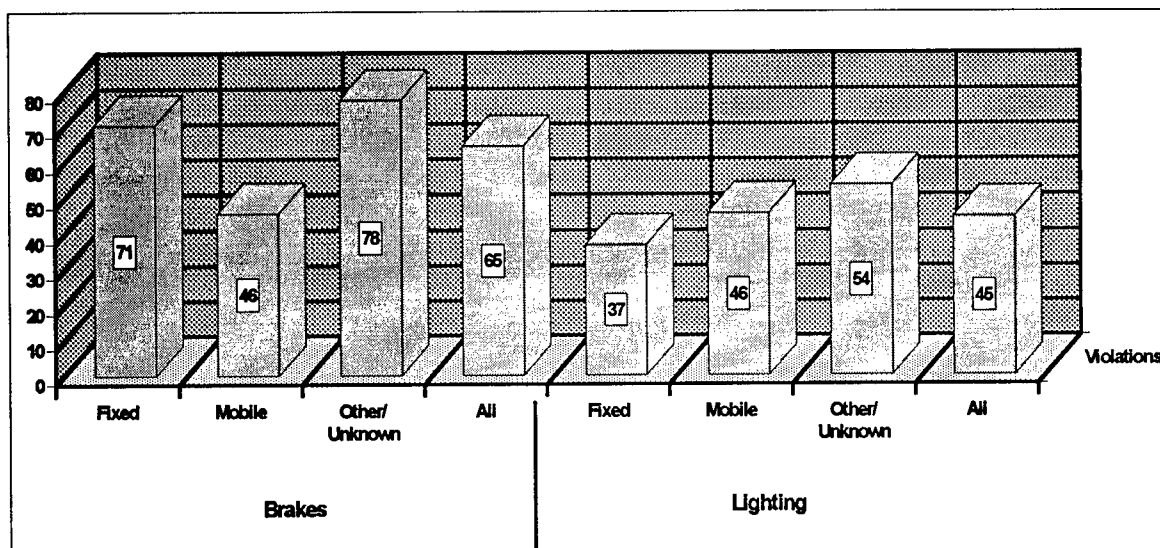


**Figure 3-7**  
**Ratio of Total Violations**  
**To Out-of-Service Violations by Facility Type**  
**N=1,449,226**

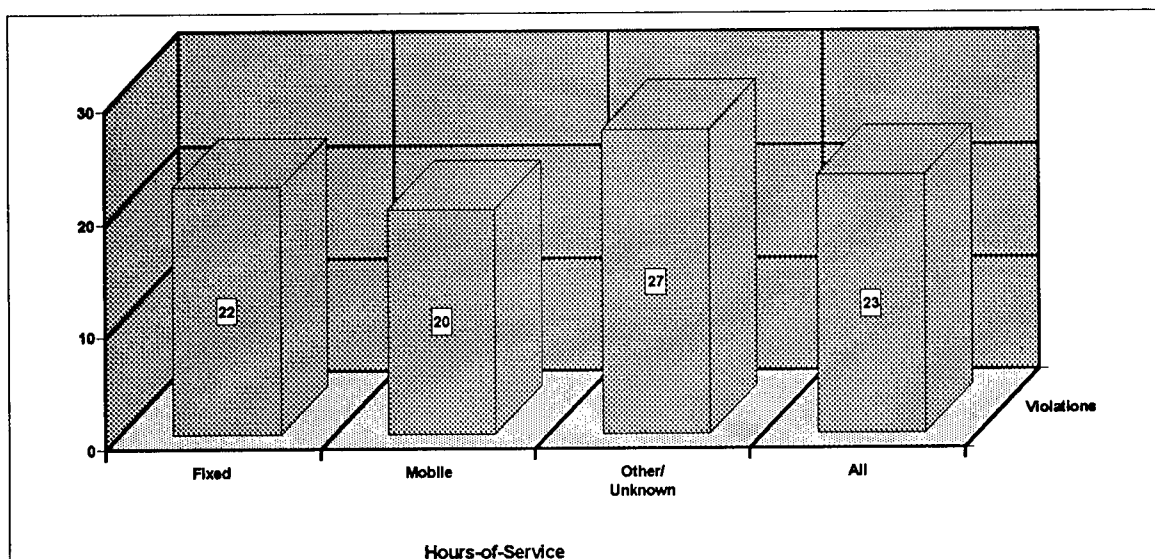
## SEASON

To examine inspection activity by seasons, inspection "months" were grouped as fol-

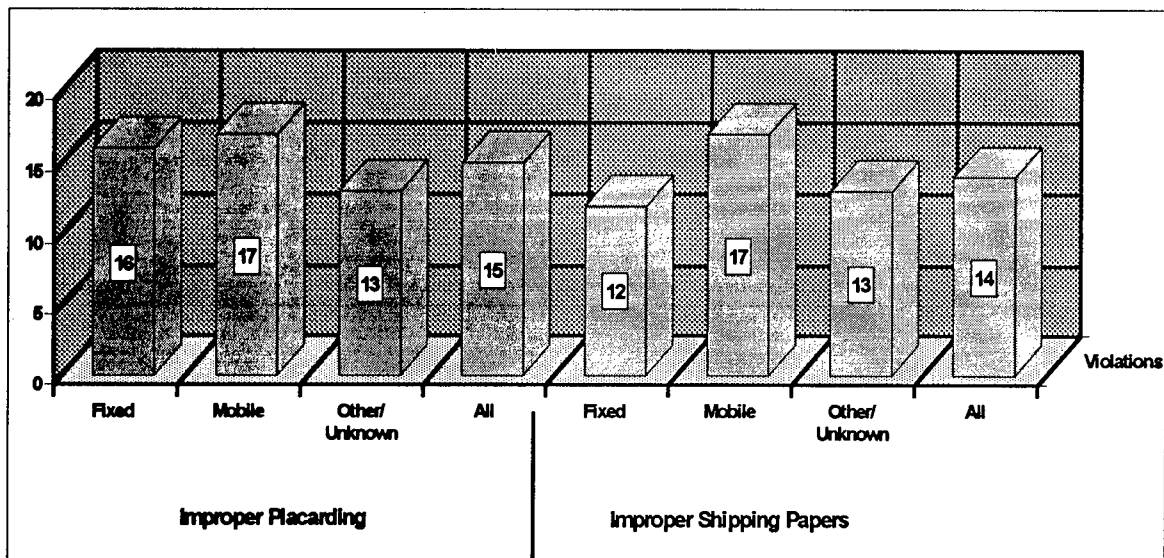
lows: January-March: *Winter*; April-June: *Spring*; July-September: *Summer*; and October-December: *Autumn*. As expected, inspection activity peaked during the warmer months and dropped off in colder weather—



**Figure 3-8**  
**Brake/Lighting Defects By Facility Type**  
 Violation Rates per 100 Inspections



**Figure 3-9**  
**Hours-of-Service Defects**  
**By Facility Type**  
 Violation Rates per 100 Inspections



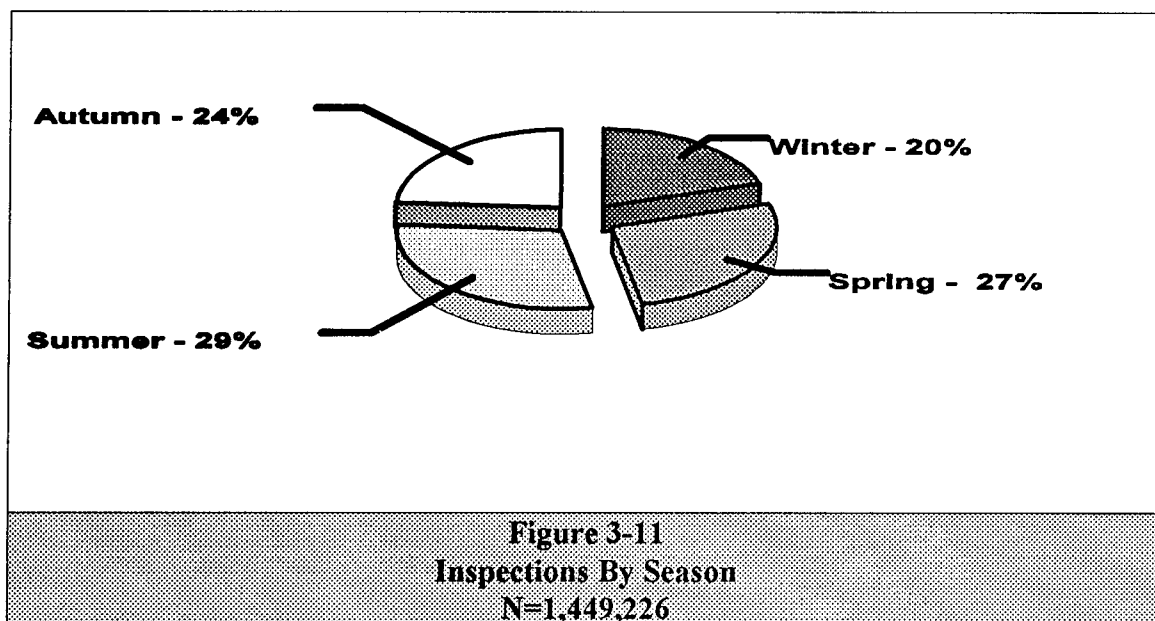
**Figure 3-10**  
**Improper Placarding/Shipping Paper Defects**  
**By Facility Type**  
**Violation Rates Per 100 Inspections**

nearly 3 out of 5 inspections performed in 1992 occurred during the Spring and Summer (Figure 3-11).

Table 3-7 compares inspection and violation activity by season, and Table 3-8 displays seasonal activity by inspection level. As

shown in the latter table, proportionally more Full Inspections were conducted in Summer, whereas Walk-Arounds were performed with greater frequency in Winter.

Though the differences were not dramatic, violation rates did appear to vary by season



**Figure 3-11**  
**Inspections By Season**  
**N=1,449,226**

**Table 3-7**  
**Inspection and Violation Counts**  
**By Season**

	Winter		Spring		Summer		Autumn		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Inspections	290,910	20.1%	385,905	26.6%	422,665	29.2%	349,746	24.1%	1,449,226	100.0%
Violations	733,857	19.6%	1,028,582	27.4%	1,114,476	28.7%	873,265	23.3%	3,749,910	100.0%
OOS Violations	173,321	19.5%	251,535	28.3%	267,859	30.1%	197,377	22.2%	890,092	100.0%

(Figures 3-12 through 3-15). The overall violation rate per 100 inspections was 267 and 264, respectively, in Spring and Summer versus 250 and 252, respectively, for Autumn and Winter (Figure 3-12). Most of the differences pertained to the vehicle rate which averaged 205-206 violations per 100 inspections in Spring and Summer versus 186-187 violations in Autumn and Winter (Figure 3-13). Interestingly, the driver violation rate was slightly higher in colder weather (59-60 violations per 100 inspections in Autumn and Winter versus 54-55 violations in Spring and Summer), probably because of the differences in inspection level activity by season (Figure 3-14). The hazardous materials violation rate was marginally higher in Winter and Spring than in Summer and Autumn (Figure 3-15).

Figure 3-16 depicts the ratio of violations to

out-of-service violations by season. The ratio was most favorable in Spring, when one OOS violation occurred for every 4.09 violations; surprisingly, the ratio was highest in Autumn, when one OOS violation occurred for every 4.42 violations.

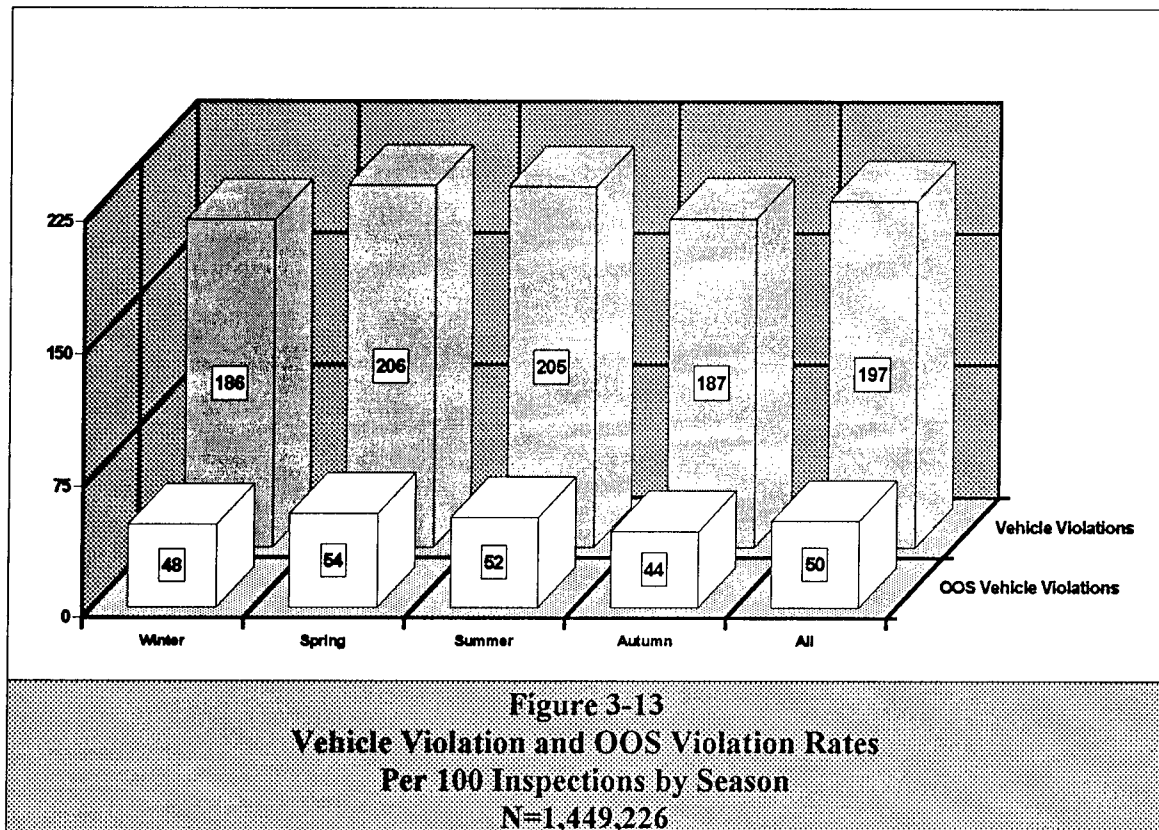
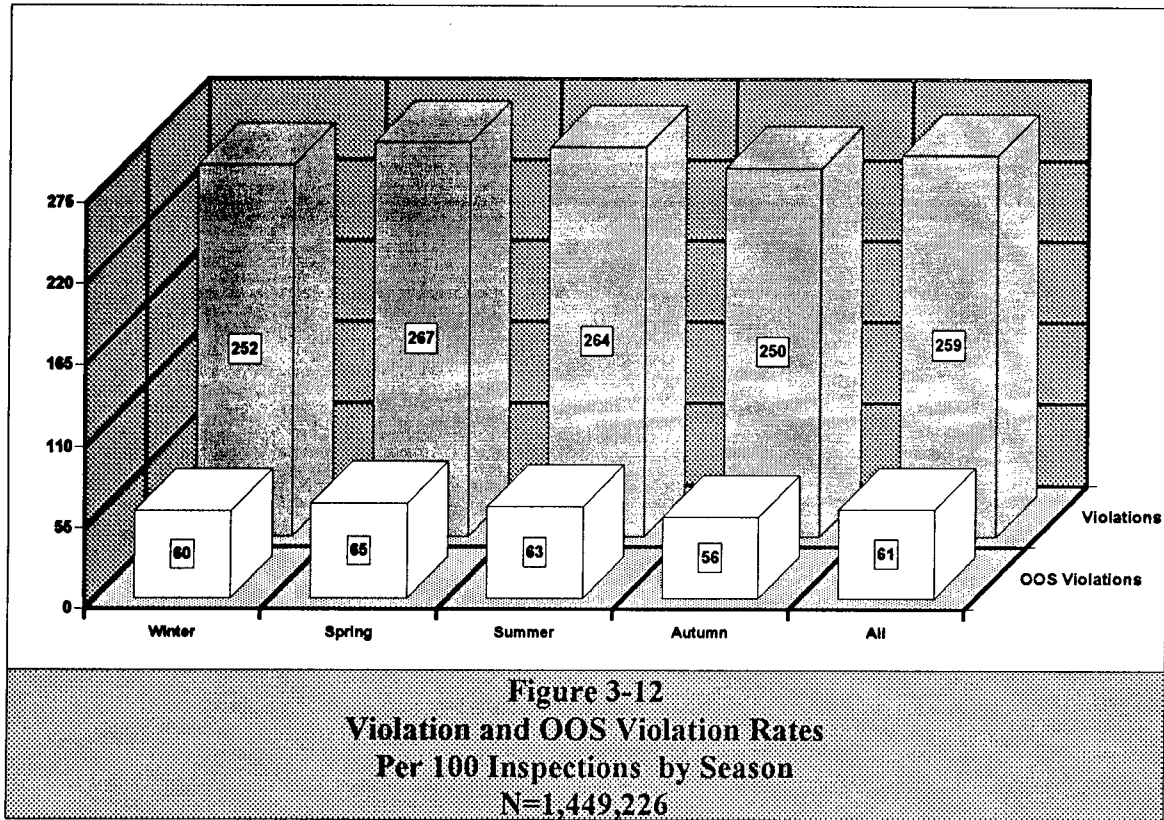
Figures 3-17 through 3-19 chronicle selected defect activities by season.

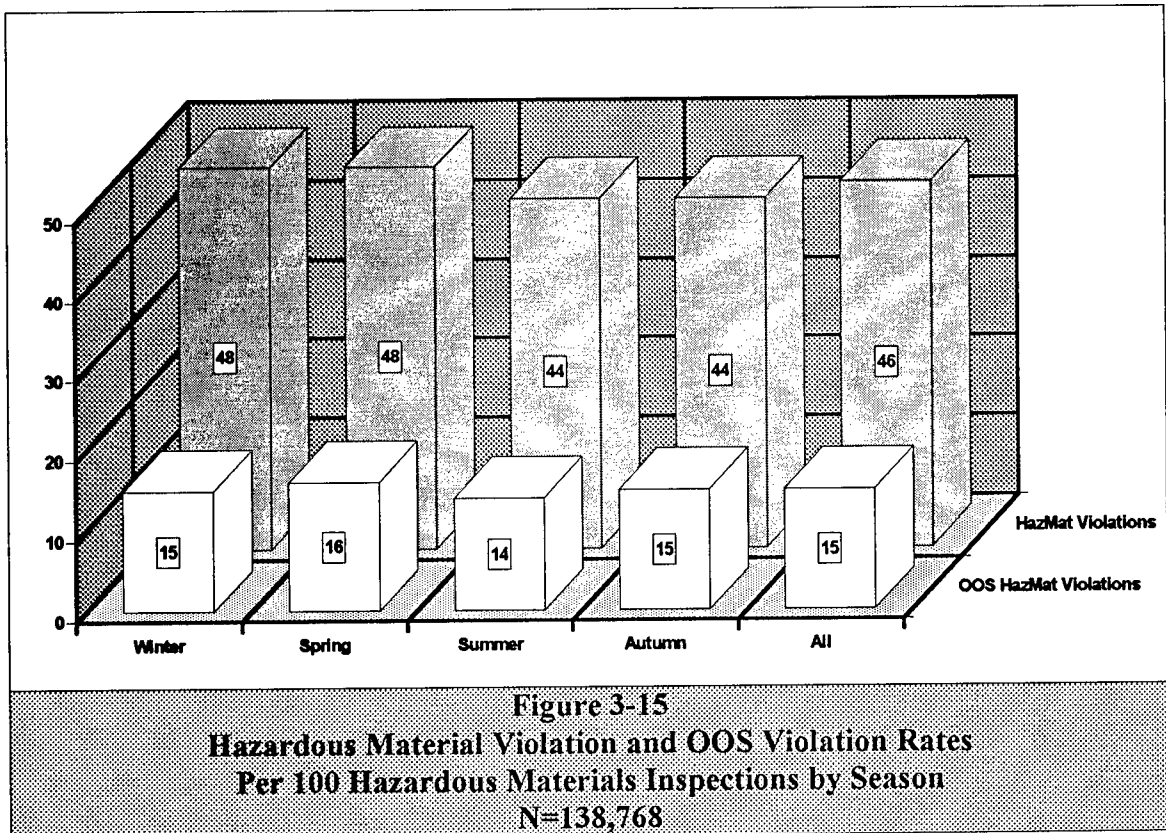
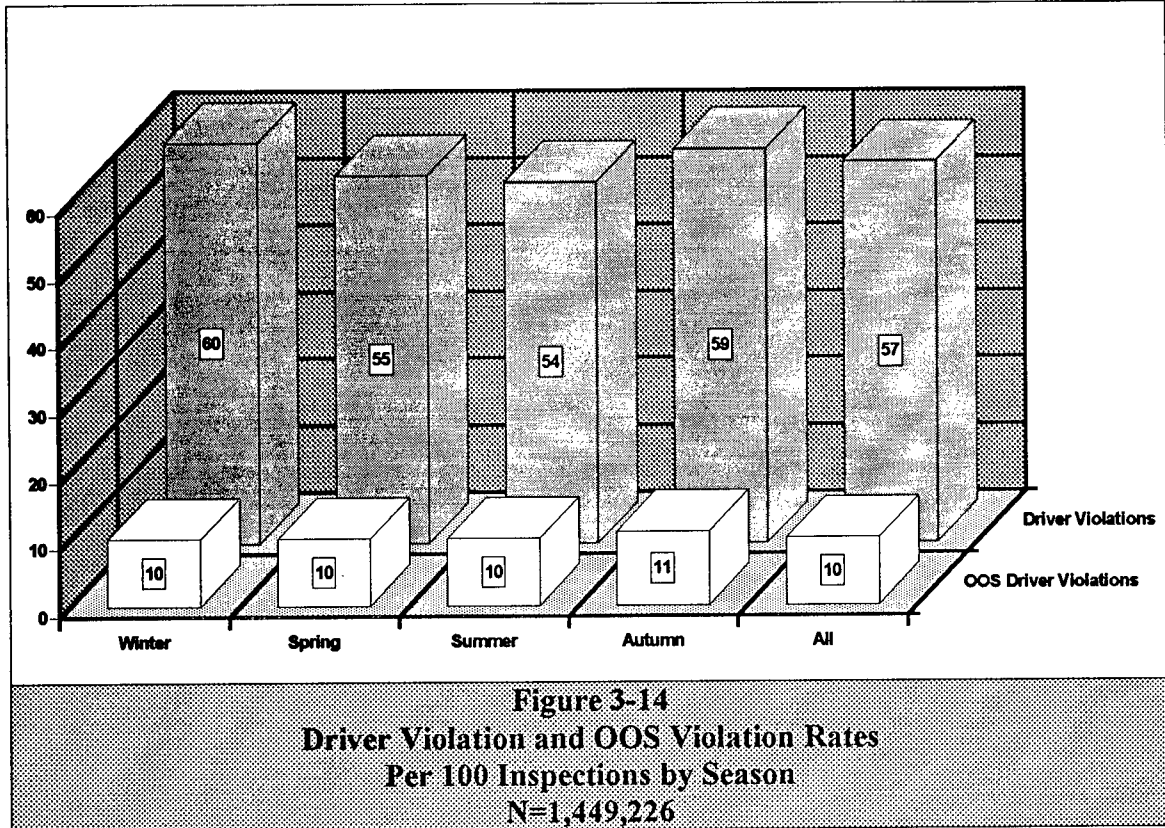
## TIME-OF-DAY

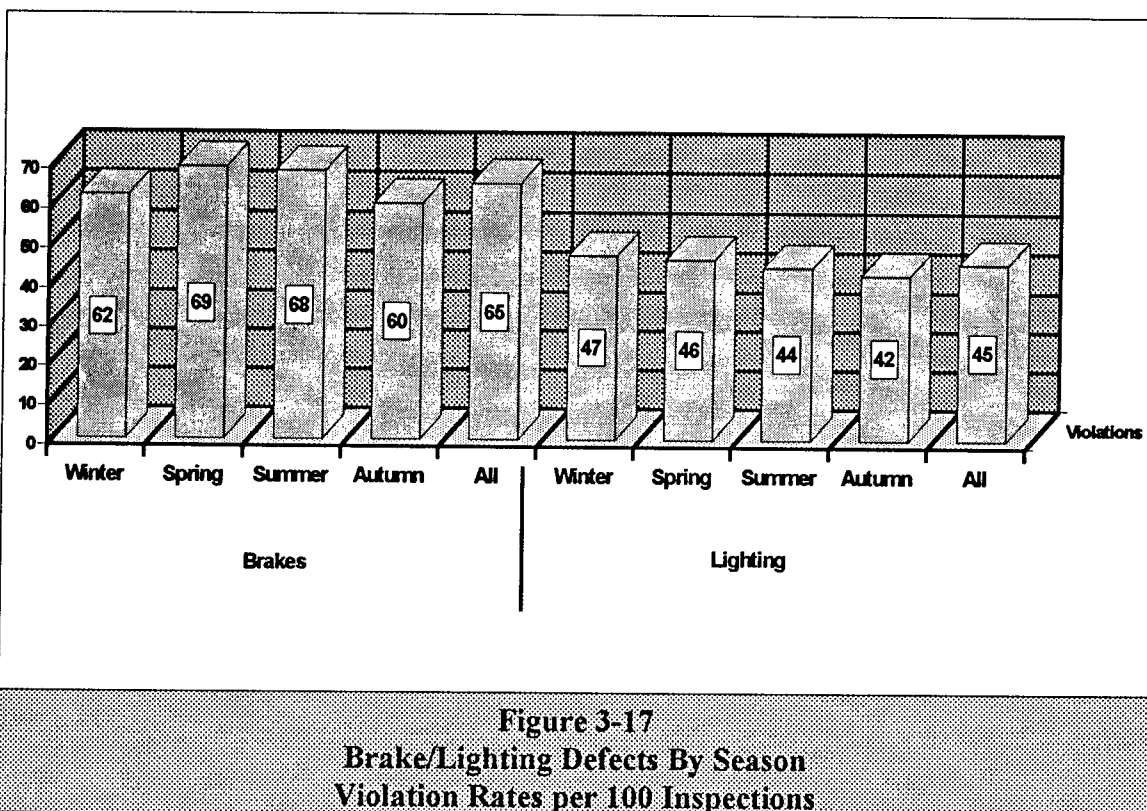
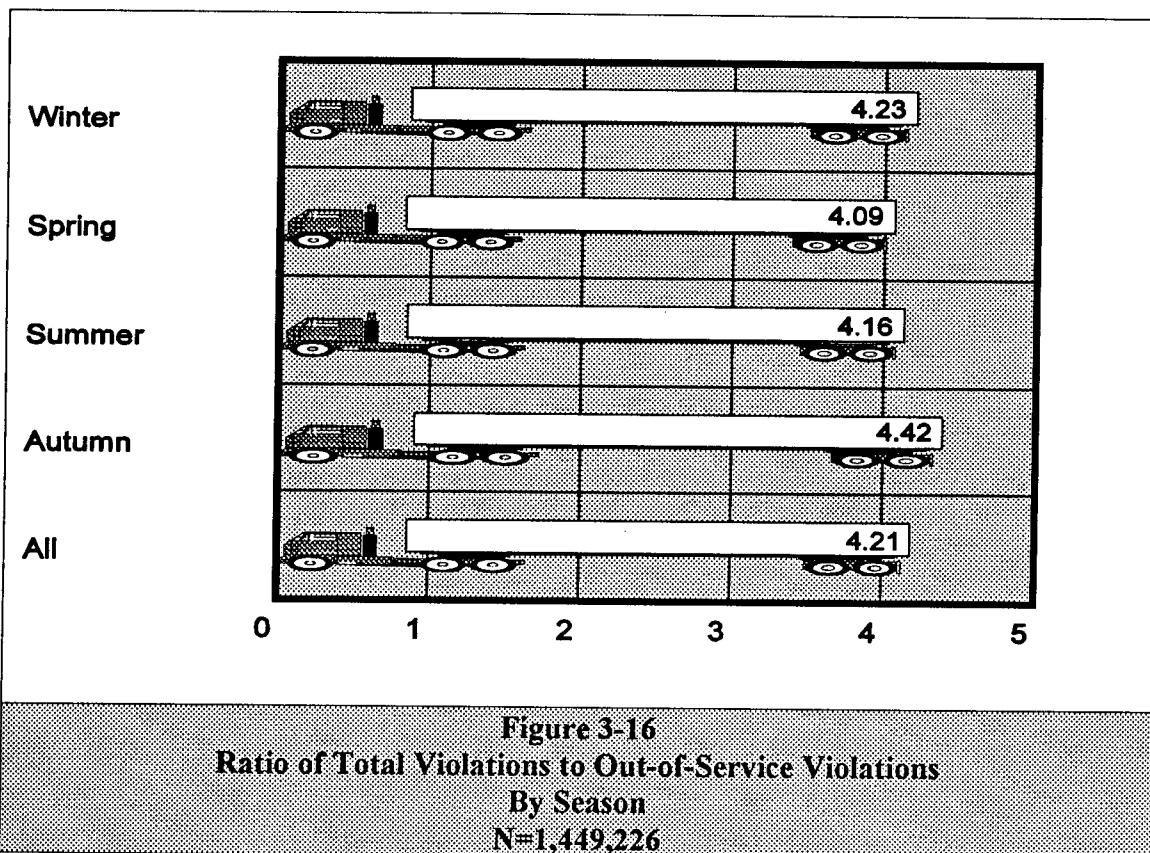
Fifty percent of all interstate inspections performed in 1992 occurred within a six-hour period: 6AM-12 Noon, and 80 percent happened within a 12-hour period: 6AM-6PM (Figure 3-20). A complete breakout of inspection activity and inspection levels by time-of-day is presented in Tables 3-9 and 3-10.

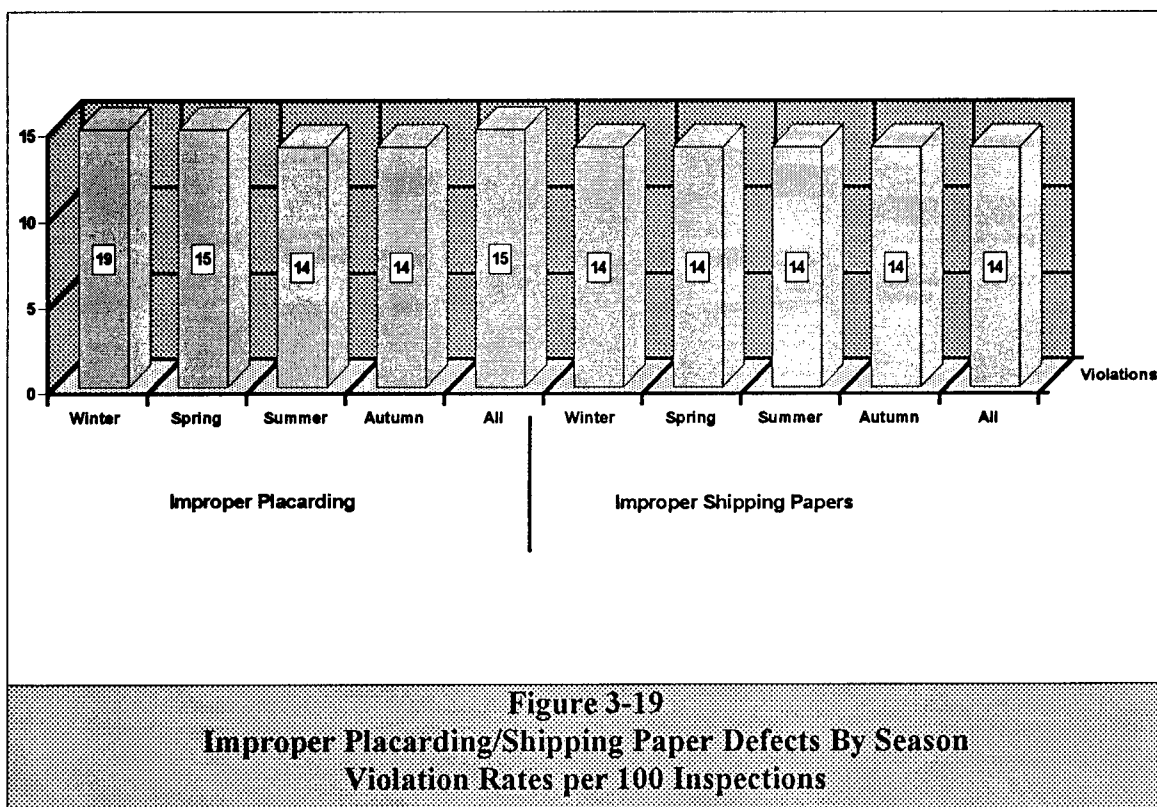
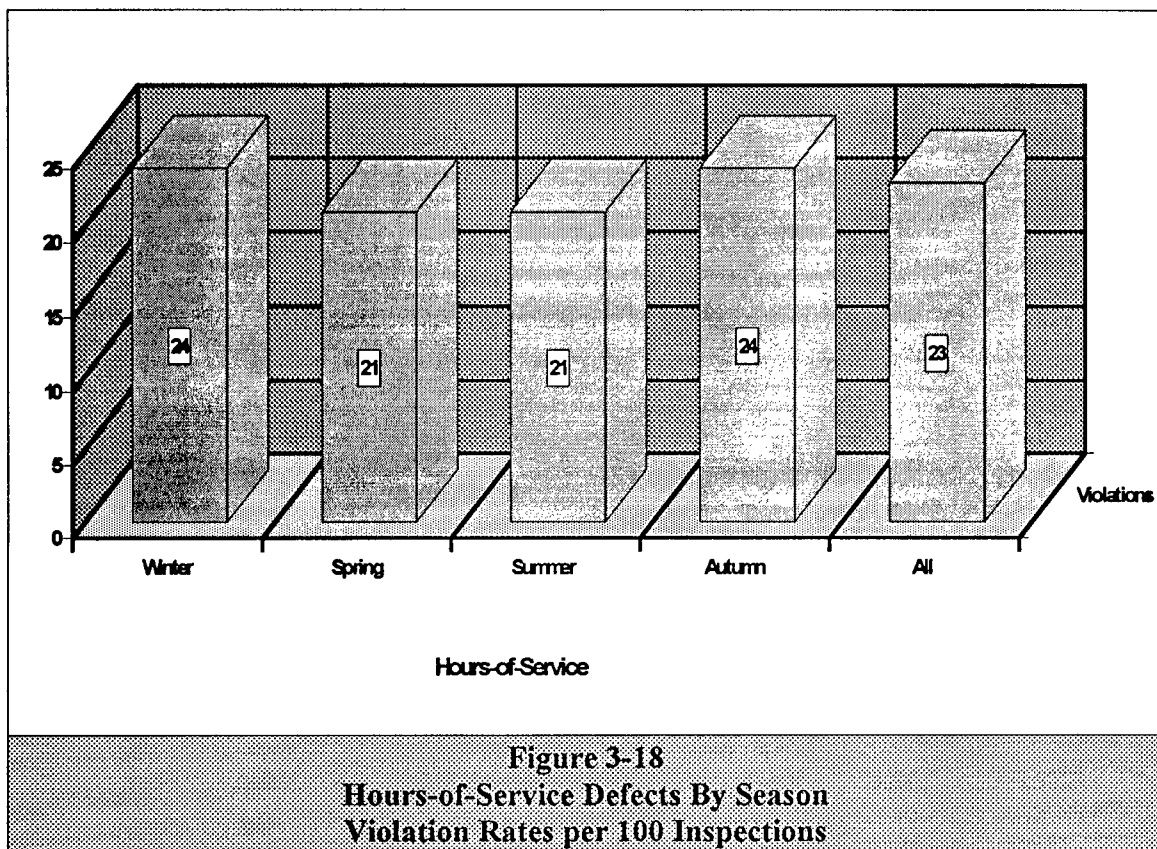
**Table 3-8**  
**Proportion of Inspections**  
**By Season and Inspection Level**

	Winter	Spring	Summer	Autumn	All
Full	52.1%	62.0%	62.2%	55.2%	58.4%
Walk-Around	34.1%	27.7%	27.3%	31.1%	29.7%
Driver-Only	12.3%	8.6%	9.2%	11.9%	10.3%
Terminal	0.5%	0.7%	0.8%	0.7%	0.7%
Special	1.1%	0.9%	0.6%	1.1%	0.9%
Total	290,910	385,905	422,665	349,746	1,449,226



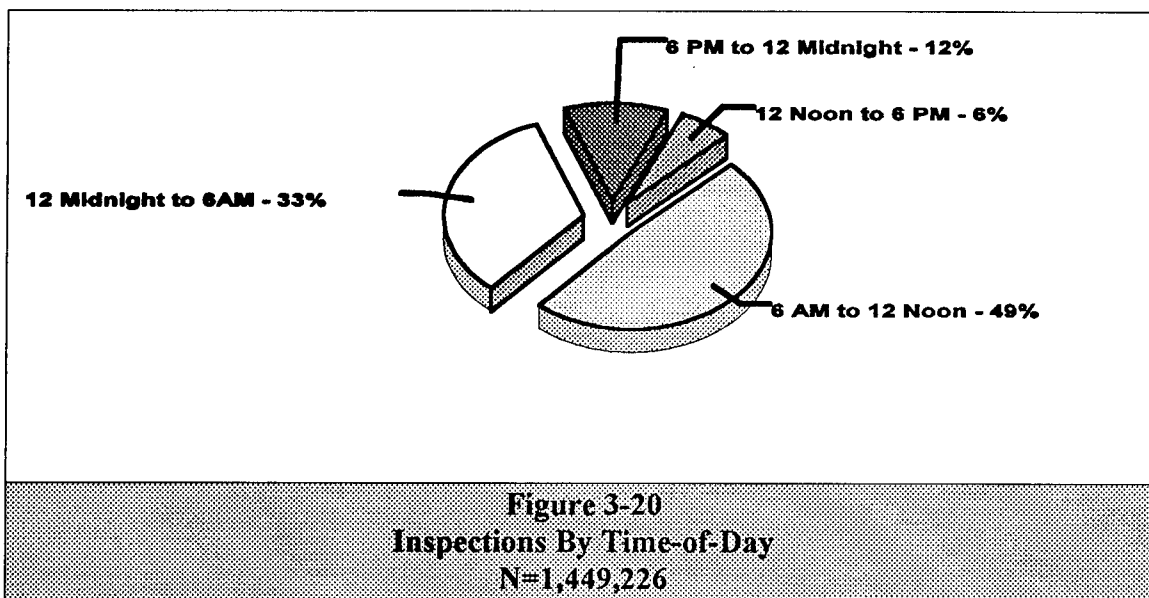






Figures 3-21 through 3-27 suggest that there were meaningful differences in inspection outcomes according to *time-of-day* of the inspections. In general, daytime inspections produced higher violation and OOS violation rates than did nighttime inspections. For instance, for every 100 inspections conducted between 6AM-12 Noon and

12 Noon-6PM, there were 270 and 261 violations, respectively (Figure 3-21). This compares with rates of 223 and 221 for inspections conducted between 12 Midnight-6AM and 6PM-12 Midnight, respectively. In other words, the violation rate was approximately 20 percent higher for inspections which occurred during daytime hours

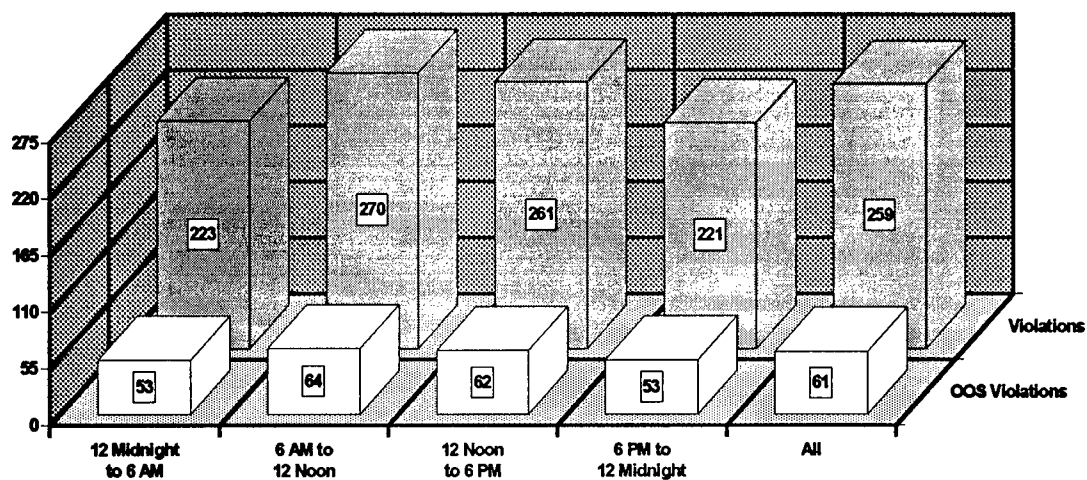


**Table 3-9**  
**Inspection and Violation Counts**  
**By Time-of-Day**

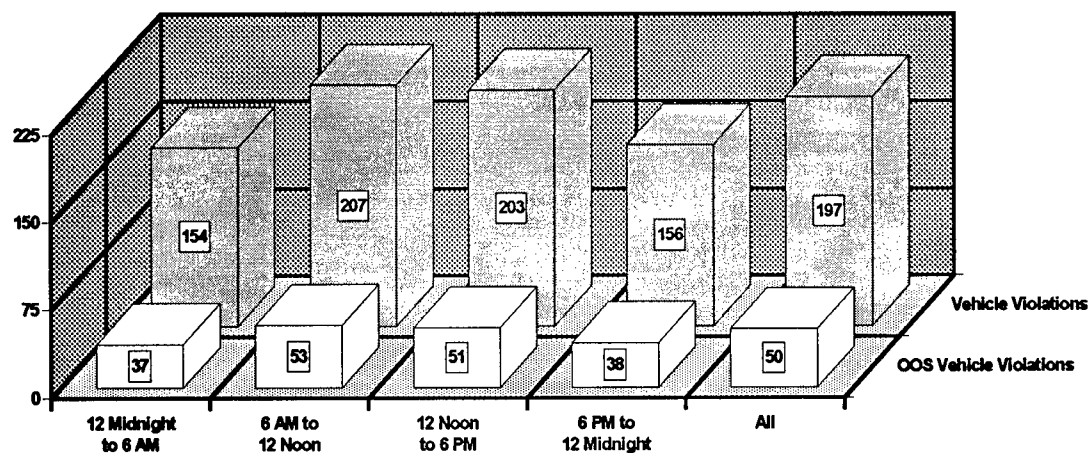
	12 Midnight to 6 AM		6 AM to 12 Noon		12 Noon to 6 PM		6 PM to 12 Midnight		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Inspections	83,935	5.8%	700,659	49.0%	486,340	33.6%	189,292	11.7%	1,449,226	100.0%
Violations	187,497	5.0%	1,916,382	51.1%	1,271,582	33.9%	374,449	9.9%	3,749,910	100.0%
OOS Violations	44,407	5.0%	452,947	50.9%	303,519	34.1%	89,219	10.0%	890,092	100.0%

**Table 3-10**  
**Proportion of Inspections**  
**By Time-of-Day and Inspection Level**

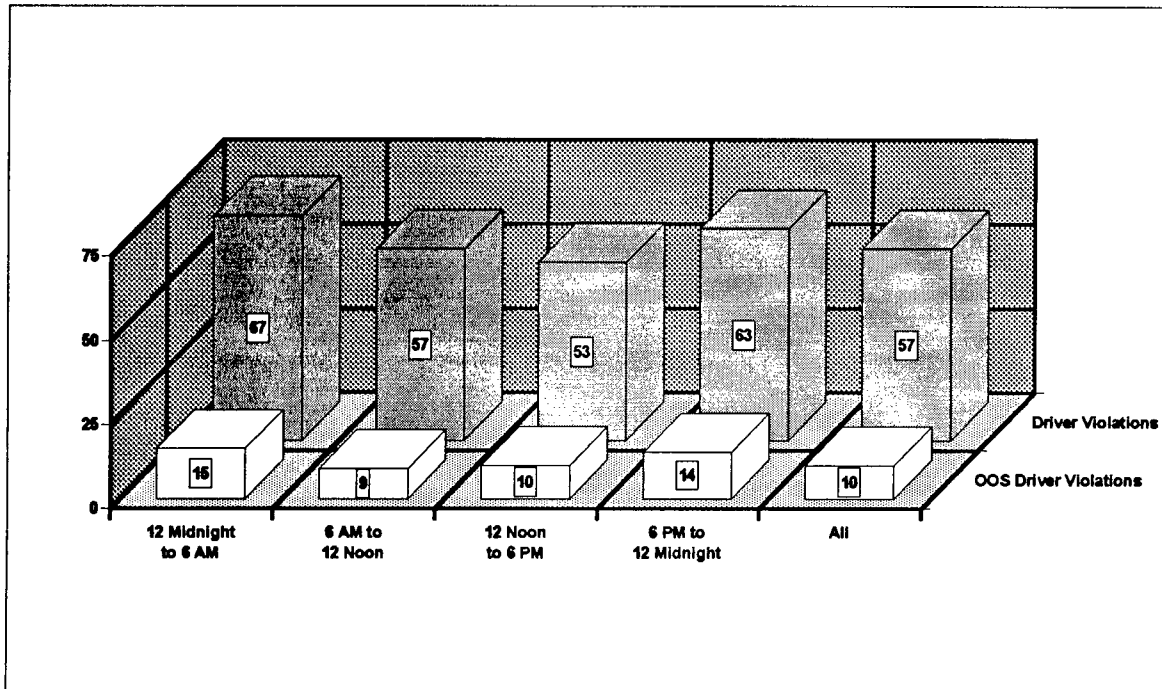
	12 Midnight to 6 AM	6 AM to 12 Noon	12 Noon to 6 PM	6 PM to 12 Midnight	All
Full	52.6%	61.2%	58.6%	49.1%	58.4%
Walk-Around	27.8%	29.2%	29.9%	32.1%	29.7%
Driver-Only	18.6%	8.0%	9.8%	17.5%	10.3%
Terminal	0.1%	0.9%	0.6%	0.1%	0.7%
Special	0.9%	0.7%	1.0%	1.2%	0.9%
Total	83,935	709,659	486,340	169,292	1,449,226



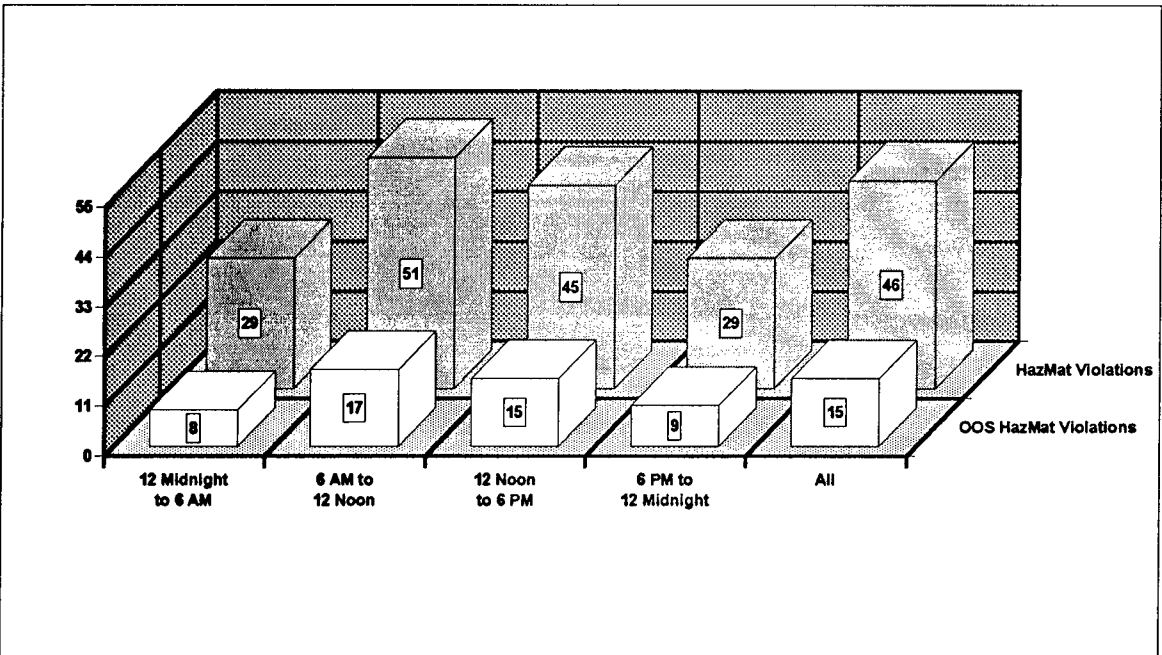
**Figure 3-21**  
**Violation and OOS Violation Rates**  
**Per 100 Inspections by Time-of-Day**  
**N=1,449,226**



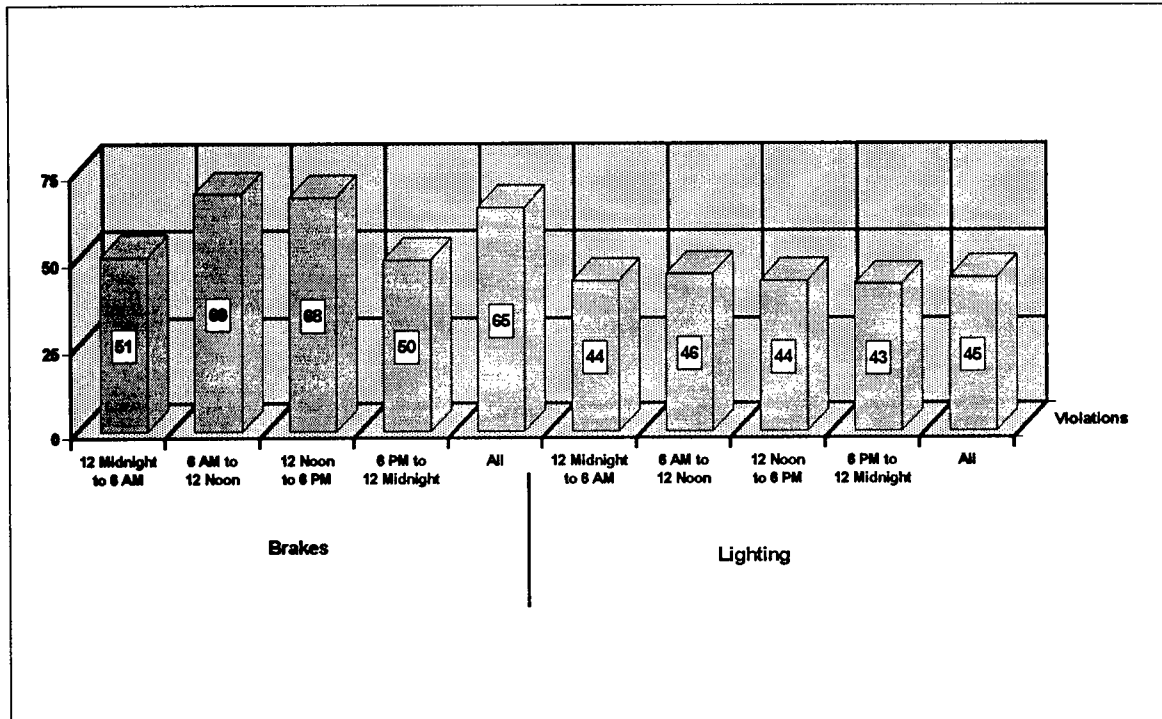
**Figure 3-22**  
**Vehicle Violation and OOS Violation Rates**  
**Per 100 Inspections by Time-of-Day**  
**N=1,449,226**



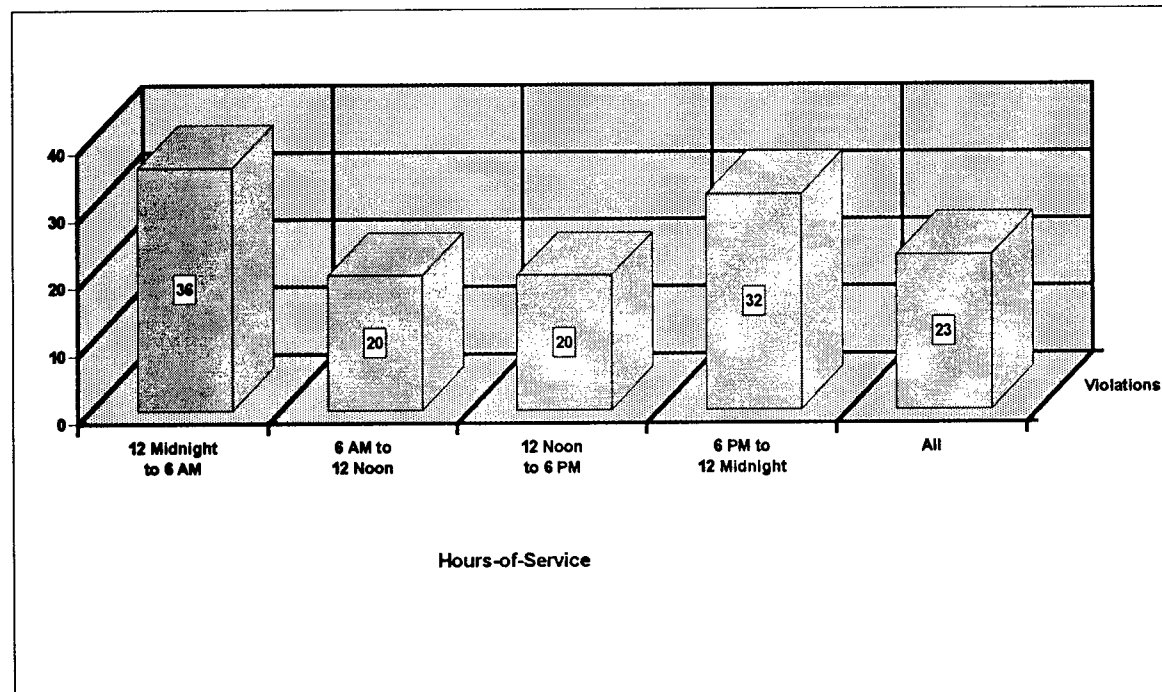
**Figure 3-23**  
**Driver Violation and OOS Violation Rates**  
**Per 100 Inspections by Time-of-Day**  
**N=1,449,226**



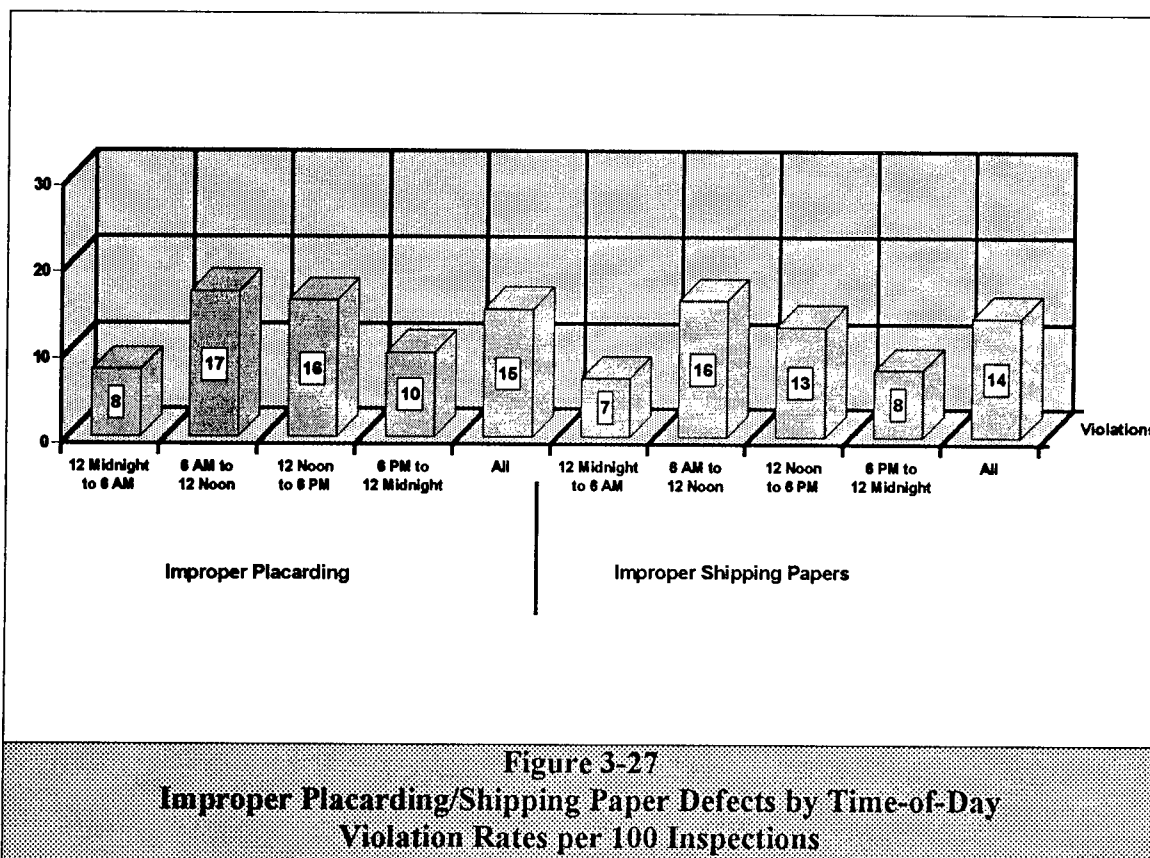
**Figure 3-24**  
**Hazardous Materials Violation and OOS Violation Rates**  
**Per 100 Hazardous Materials Inspections by Time-of-Day**  
**N=138,839**



**Figure 3-25**  
Brake/Lighting Defects By Time-of-Day  
Violation Rates per 100 Inspections



**Figure 3-26**  
Hours-of-Service Defects By Time-of-Day  
Violation Rates per 100 Inspections



(6AM-6PM) than nighttime hours (6PM-6AM).

These differences are even more pronounced when vehicle and hazardous materials violation rates are examined separately (Figures 3-22 and 3-24). Vehicle violation rates were 33 percent higher for daytime versus nighttime inspections, while hazardous materials violation rates were 66 percent higher. The sole exception pertained to driver violation rates, which were 14 percent lower during the day (Figure 3-23). The ratio of violations to out-of-service violations did not fluctuate significantly by time-of-day.

Some of the differences in daytime versus nighttime violation rates are, perhaps, explainable. One theoretical possibility is that commercial vehicles travelling at night were

better maintained than their daytime counterparts. This is not a particularly satisfying explanation, given that many interstate vehicles moved both during the day and at night; furthermore, the boundaries between daytime and nighttime travel were not rigid—long-haul trips beginning during the night were often likely to end after daybreak, and vice-versa. A better explanation might be that some defects—especially defects pertaining to the vehicle—were difficult to detect during the night. For instance, as shown in Figure 3-25, the daytime rate of brake violations was 68, as opposed to a rate of 50 for the nighttime. On the other hand, there was relatively little difference in the rate of lighting defects—45 for daytime versus 43 for nighttime—not surprising, since most lighting defects should have been equally detectable during day or night. Finally, given that less time could produc-

tively be spent on the detection of vehicle violations, some inspectors may have viewed the nighttime as an opportunity to examine more thoroughly driver compliance with safety regulations; this, in part, could account for the slight increase in driver violation rates during nighttime inspections.

## DURATION

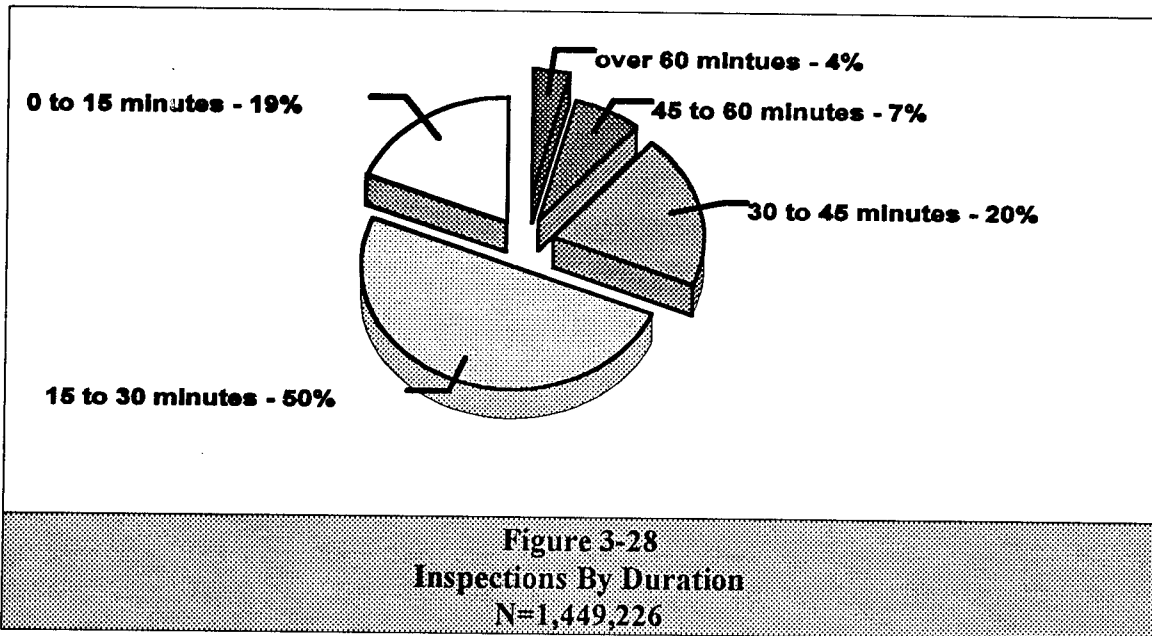
The mean duration of interstate inspections performed in 1992 was 31 minutes. Sixty-nine percent of the inspections conducted during the year were completed in 30 minutes or less, while 27 percent lasted 30-60 minutes; only 4 percent of the inspections had durations in excess of 60 minutes (Figure 3-28). A breakout of inspections and violations by duration is presented in Table 3-11. Figure 3-29 specifies the mean duration of inspections by level. Fifty percent more time was required to complete a Full Inspection (33 minutes) than a Driver-Only Inspection (22 minutes); Walk-Arounds were midway between the two extremes at 28 minutes. As indicated in Figure 3-30, vehicle configuration had a relatively weak impact on inspection duration. While 50 percent of all inspections had durations of 15-30 minutes, 51 percent of straight trucks, 50 percent of singles, 49 percent of doubles, and 48 percent of triples fell within this range. At the upper-end of the continuum of inspection durations, vehicle configuration had a slightly stronger—though far from overwhelming—impact. Only 2 percent of all inspections involving straight trucks lasted more than 60 minutes; this compared with 5 percent of singles, 6 percent of doubles, and 8 percent of triples.

Also, there were not marked differences in duration between inspections involving hazardous and non-hazardous materials. In-

deed, inspections of vehicles transporting hazardous materials had, on average, a shorter duration (28 minutes) than did inspections involving non-hazardous materials (32 minutes). This finding may be explained, in part, by observations discussed in Chapter 2—i.e., that vehicles and drivers transporting hazardous materials tended to have fewer defects than did their non-hazardous counterparts.

Figures 3-31 through 3-34 suggest the existence of a strong correlation between inspection duration and inspection outcomes. Inspections completed in 15 minutes or less averaged 111 violations per 100 inspections (Figure 3-31); this rate increased by 95 percent, to 216 violations, when average duration was extended by 15 minutes. In fact, the violation rate increased by 442 percent, to 602 violations per 100 inspections, as average duration expanded from 15 minutes or less to 60 minutes or more. Of course, what is not clear from the data is whether the mere performance of longer inspections yielded more violations, or whether protracted inspections were, instead, performed precisely *because* they involved those vehicles and drivers which had more violations in the first place. To put it another way: Would a 15-minute inspection have resulted in the detection of substantive additional violations if more time had been expended on the inspection?

In addition to there being a strong correlation between inspection durations and inspection outcomes, the severity of violations, themselves, appeared to increase as inspection length increased. As shown in Figure 3-35, the ratio of total violations-to-OOS violations declined from 5.4, for inspections of less than 15 minutes duration, to 3.0, for inspections which were more than 60 minutes in length.



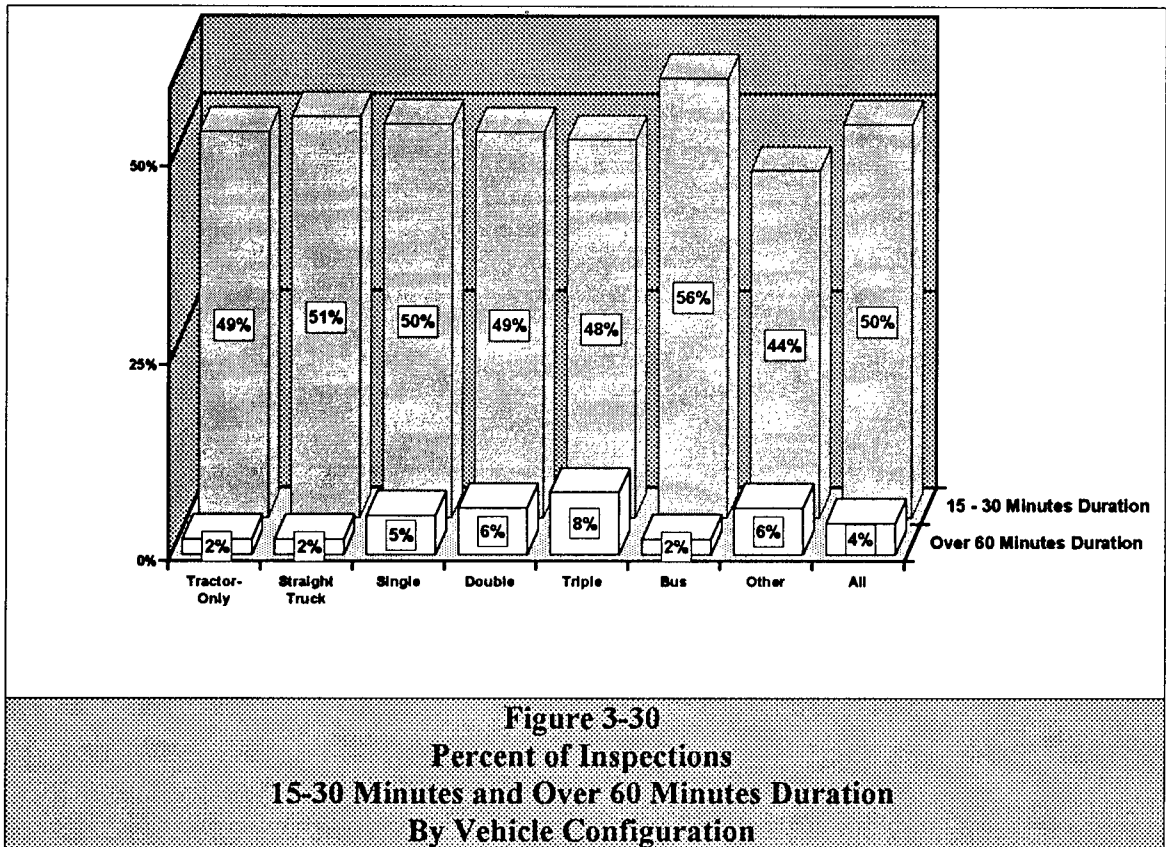
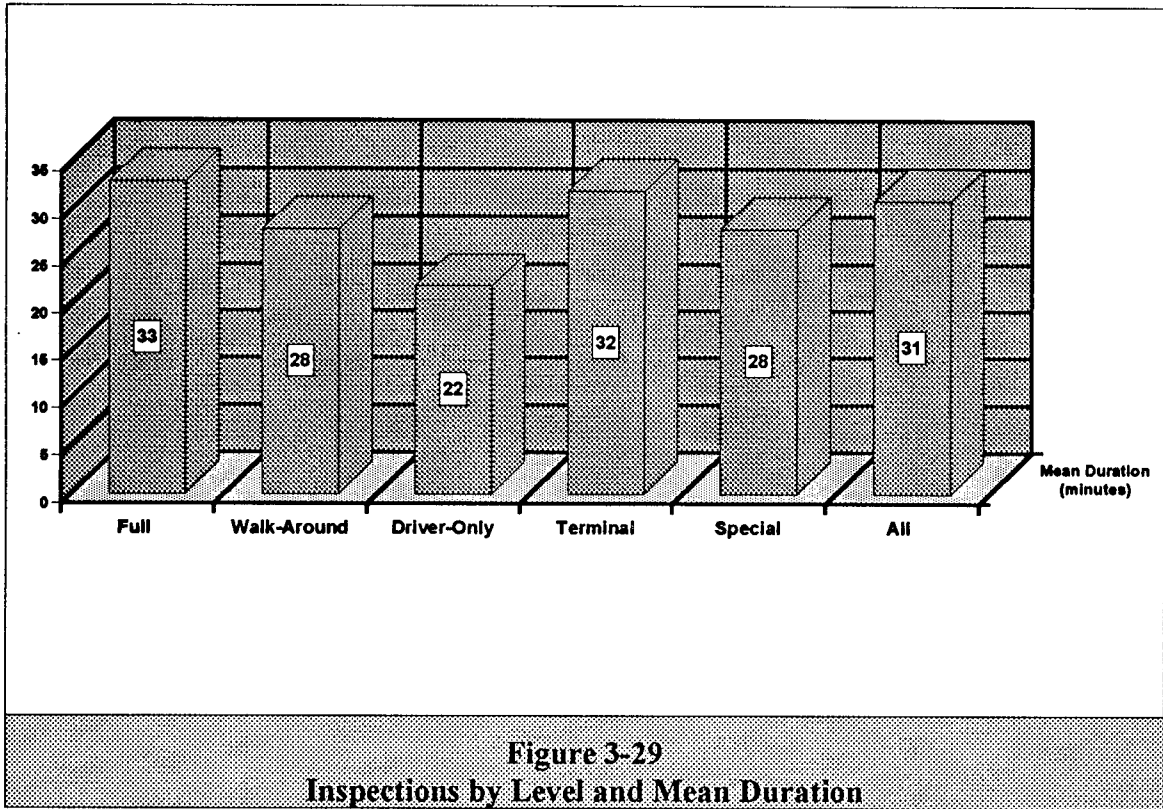
**Table 3-11**  
**Inspection and Violation Counts**  
**By Inspection Duration**

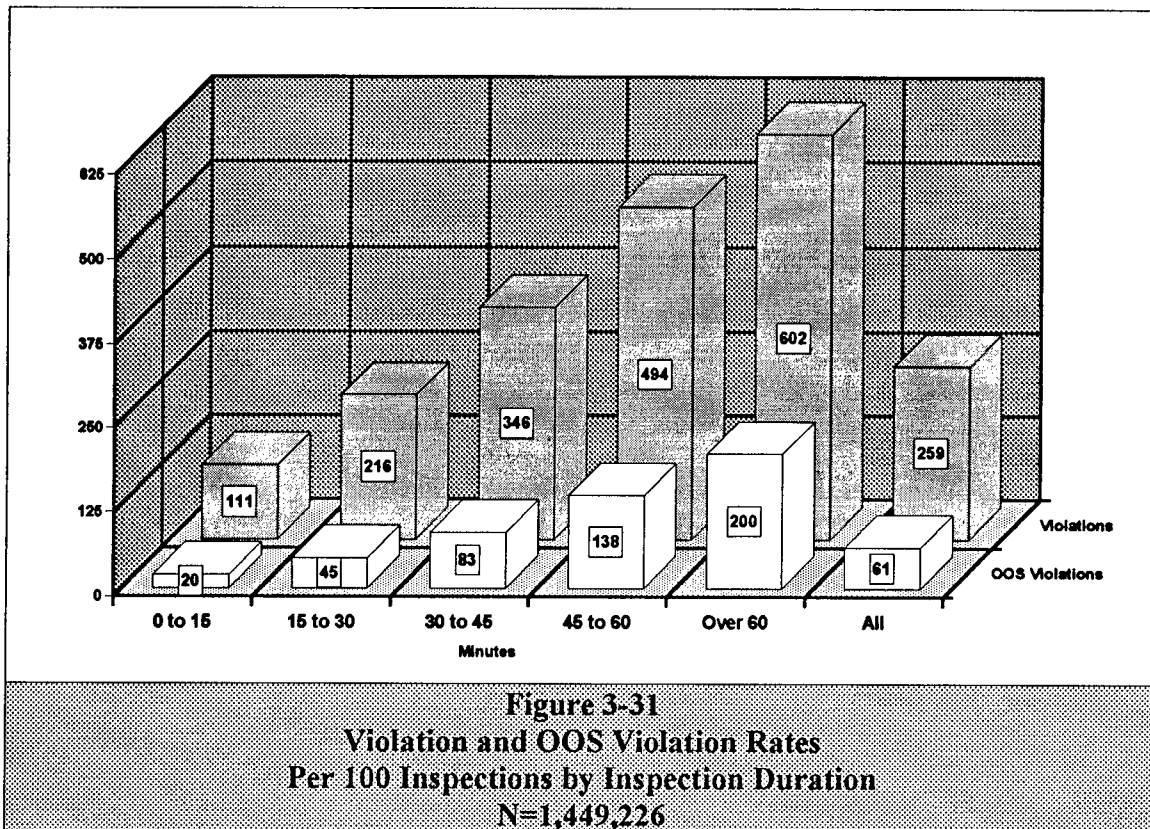
	0 to 15 minutes		15 to 30 minutes		30 to 45 minutes		45 to 60 minutes		Over 60 minutes		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Inspections	270,560	18.7%	719,137	49.6%	295,192	20.4%	105,010	7.2%	59,327	4.1%	1,449,226	100.0%
Violations	299,150	8.0%	1,553,227	41.4%	10,214,448	27.2%	518,753	13.8%	357,332	9.5%	3,749,910	100.0%
OOS Violations	55,001	6.2%	326,433	36.7%	245,531	27.6%	144,413	16.2%	118,714	13.3%	890,092	100.0%

The results are even more striking when individual defects are examined (Figures 3-36 through 3-38). For instance, brake violations were detected at a rate of 19, 53, and 165 violations (per 100 inspections) for durations of 0-15 minutes, 15-30 minutes, and over 60 minutes, respectively (Figure 3-36). What is not shown is that the corresponding OOS violation rates for brakes were 6, 19, and 92, respectively; the violation ratios were 3.2, 2.8, and 1.8, respectively. Thus, not only did the raw number of violations increase dramatically with longer inspections, but the proportion of violations designated out-of-service also rose significantly.

We return, finally, to an issue first raised early in this report—namely, the identification of the *optimal* inspection methodology. The optimal methodology is defined here as that inspection technique which yields the highest violation and OOS violation rates across a common timeframe.

In Table 3-12, the national averages for inspection duration are used to calculate mean violation and OOS violation rates per *inspection-hour*. For example, since the average Driver-Only Inspection was 22 minutes in length, one could expect to perform 2.72 inspections over a period of 60 minutes; because the average Driver-Only In-

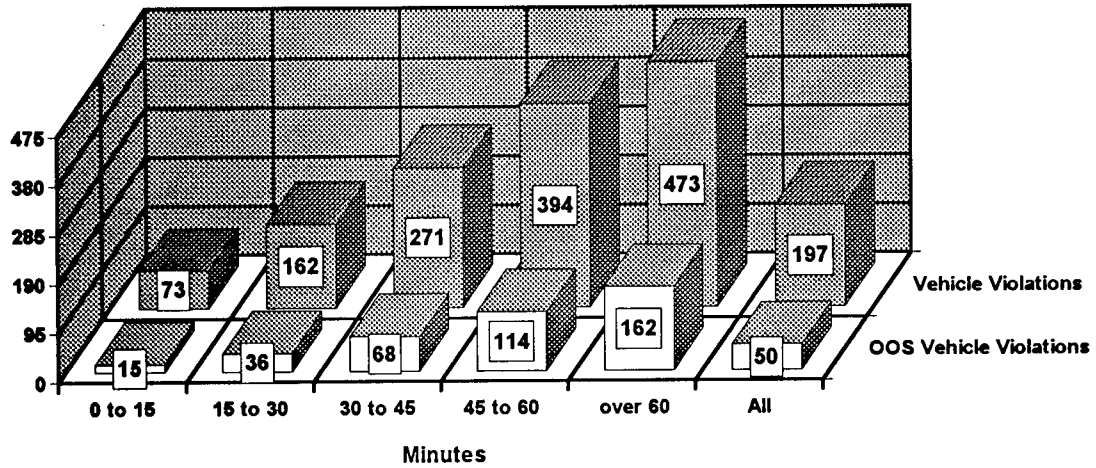




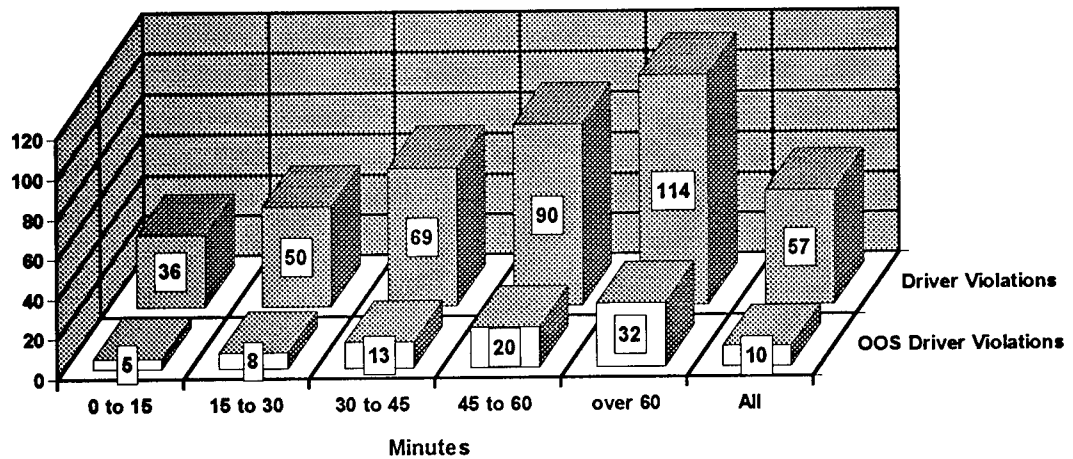
spection resulted in 0.86 violations per inspection, one would then expect to detect 2.34 violations over a period of 60 minutes ( $2.72 * 0.86$ ). In other words, in 1992, Driver-Only Inspections yielded an average of 2.34 violations and 0.49 OOS violations per inspection-hour. This compared with 4.78 violations and 0.86 OOS violations for Walk-Arounds—and 5.56 violations and 1.45 OOS violations for Full Inspections—per inspection-hour.

Full Inspections, in 1992, clearly constituted the optimal methodology, if the goal was to maximize the detection of violations. Not only was the raw count of violations per inspection-hour highest with Full Inspections, but the low violation-to-OOS violation ratio (3.8) shows that Full Inspections were most likely to result in the detection of the severest violations.

Of course, if the goal was to inspect a greater percentage of all the vehicles passing through inspection facilities—or to look for specific vehicle or driver defects—the other inspection methodologies might sometimes have been preferable.



**Figure 3-32**  
**Vehicle Violation and OOS Violation Rates**  
**Per 100 Inspections by Inspection Duration**  
**N=1,449,226**



**Figure 3-33**  
**Driver Violation and OOS Violation Rates**  
**Per 100 Inspections by Inspection Duration**  
**N=1,449,226**

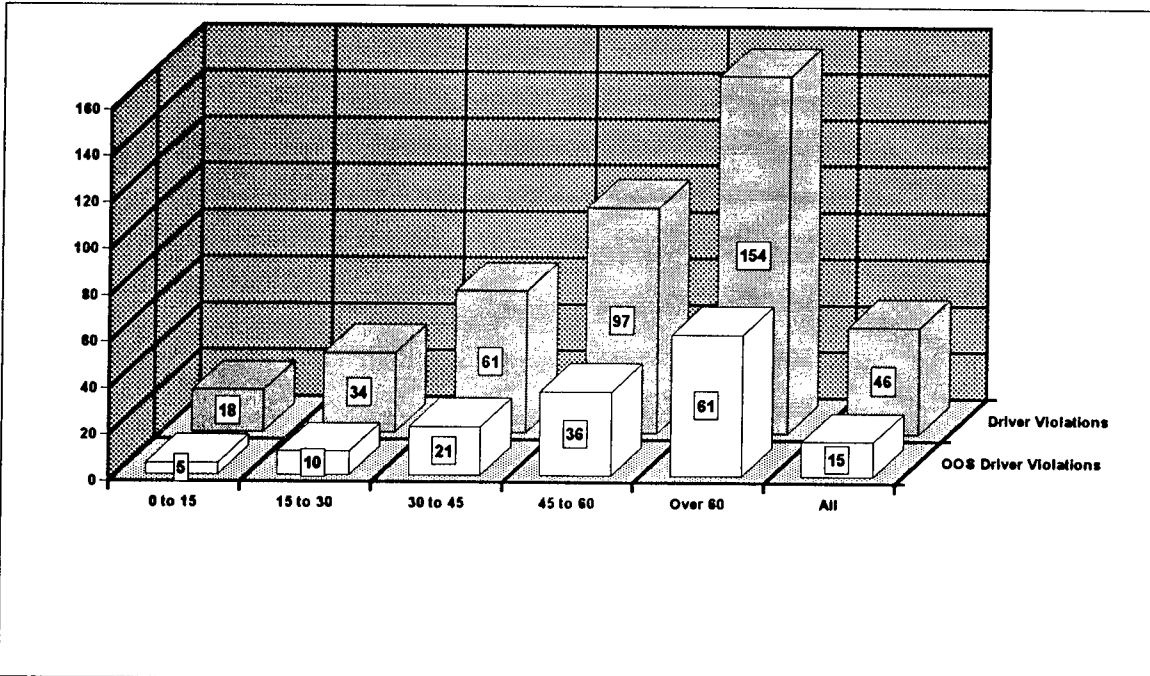


Figure 3-34  
Hazardous Material Violation and OOS Violation Rates  
Per 100 Hazardous Materials Inspections by Inspection Duration  
N=138,839

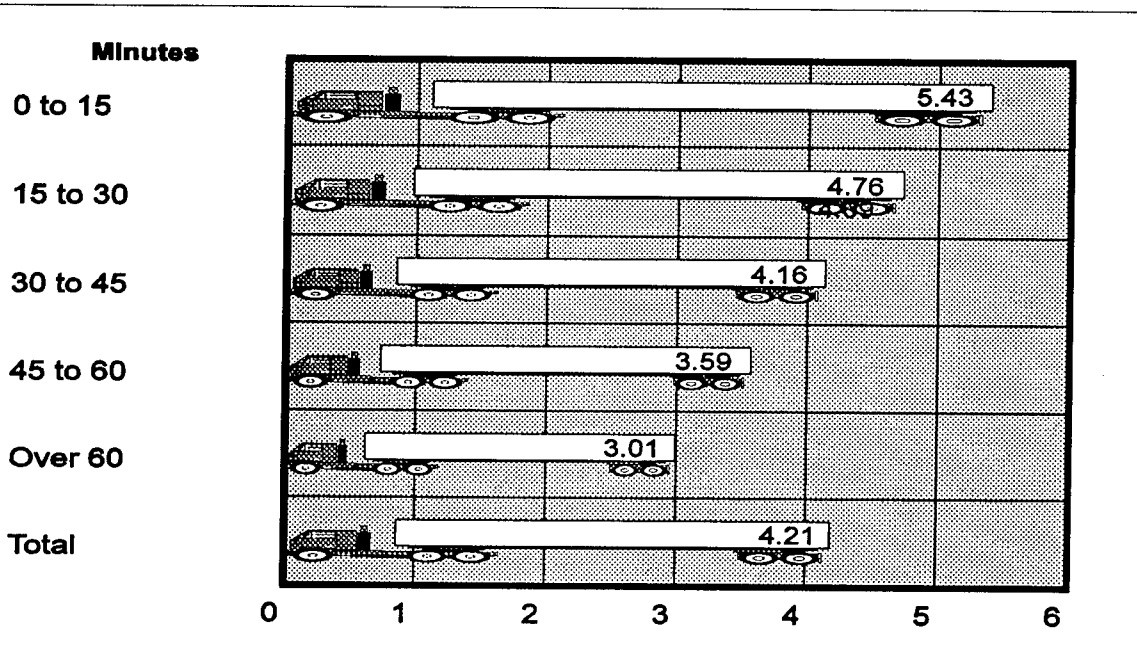


Figure 3-35  
Ratios of Total Violations to Out-of-Service Violations  
By Inspection Duration  
N=1,449,226

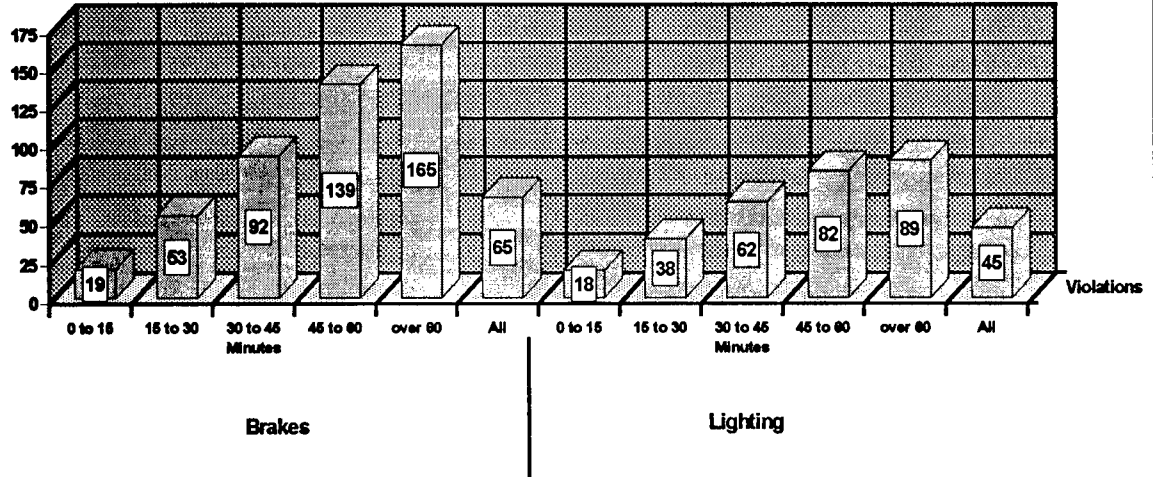


Figure 3-36  
Brake/Lighting Defects by Inspection Duration  
Violation Rates Per 100 Inspections

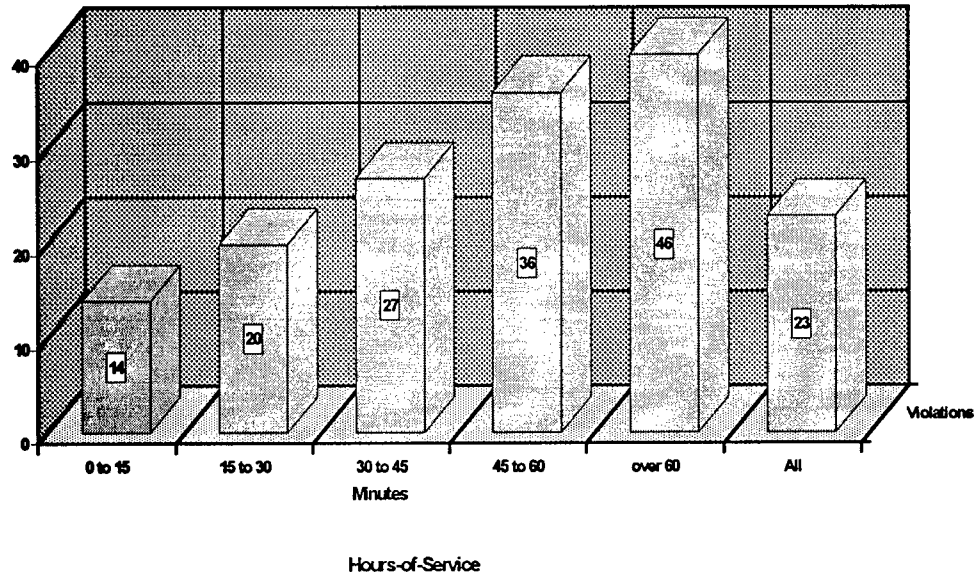
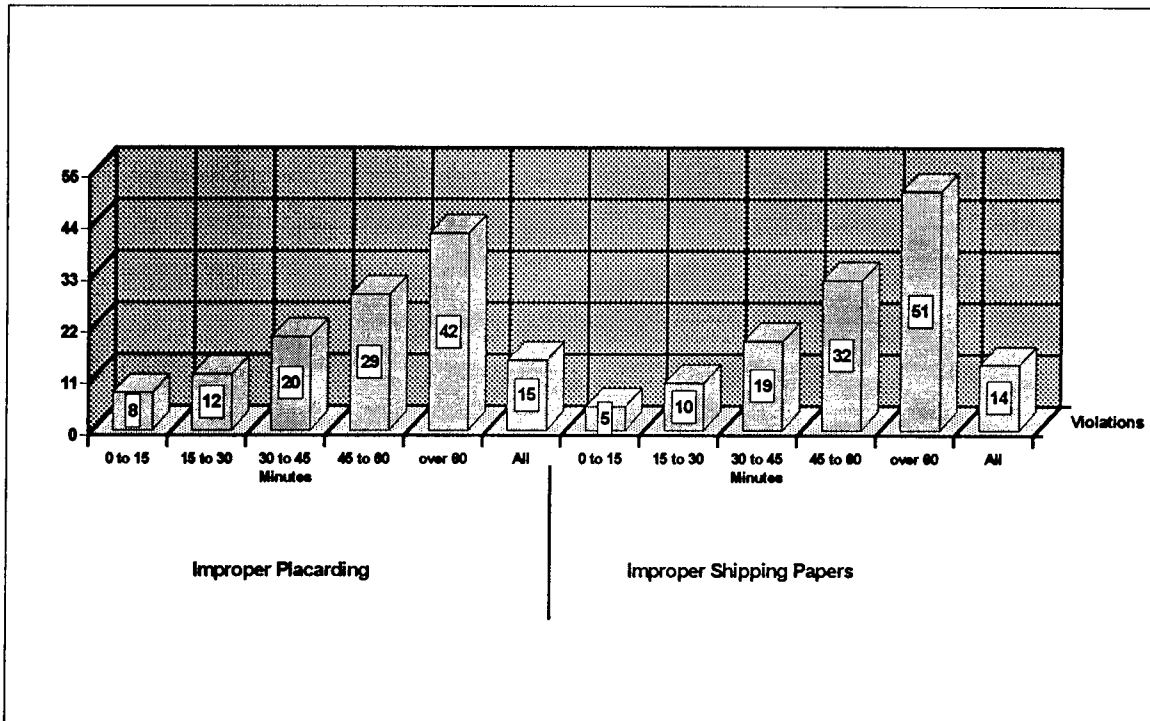


Figure 3-37  
Hours-of-Service Defects by Inspection Duration  
Violation Rates per 100 Inspections



**Figure 3-38**  
**Improper Placarding/Shipping Paper Defects by Inspection Duration**  
**Violation Rates per 100 Inspections**

**Table 3-12**  
**Violation Rates and Normalized Rates**  
**By Inspection Level and Duration**

	Full	Walk-Around	Driver-Only	Terminal	Special	All
Violations per Inspection	3.10	2.23	0.86	1.78	1.31	2.59
OOS Violations per Inspection	0.81	0.40	0.18	0.53	0.27	0.61
Ratio of Violations to OOS Violations	3.83	5.58	4.78	3.36	4.85	4.25
Mean Duration (Minutes)	33.44	27.97	22.05	32.19	27.56	30.58
Mean Number of Inspections per Hour	1.79	2.15	2.72	1.86	2.18	1.96
Violations per Hour	5.56	4.78	2.34	3.32	2.85	5.08
OOS Violations per Hour	1.45	0.86	0.49	0.99	0.59	1.20
Ratio of Violations to OOS Violation	3.83	5.58	4.78	3.36	4.85	4.25

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## **APPENDIX**

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### **Glossary of Terms Common Vehicle Configurations**

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## GLOSSARY OF TERMS

**BUS:** Any motor vehicle designed, constructed, and used for the commercial transportation of 15 or more passengers, including the driver.

**CARRIER TYPE:** "For-hire" or "private."

**COMMERCIAL VEHICLE:** A motor vehicle, usually a truck or bus, which transports freight or passengers.

**COMMERCIAL VEHICLE SAFETY ALLIANCE (CVSA):** An organization of States and Provinces in the United States, Canada, and Mexico dedicated to improving the uniformity of commercial motor vehicle safety enforcement.

**DEFECT GROUP:** The "group" to which a given violation is attributed. In this report, all violations identifiable during driver-vehicle inspections are assigned to one of three mutually-exclusive groups: *vehicles*, *drivers*, or *hazardous materials*.

**DOUBLE:** A commercial motor vehicle consisting of a truck-tractor and two detachable trailers.

**DRIVER-ONLY INSPECTION:** Examines only the driver-related aspects of the standard Full Inspection, including compliance with commercial drivers' licensing requirements, medical certifications and waivers, and the hours-of-service regulations. This inspection type is a *Level III* inspection.

**DRIVER VIOLATION:** A violation discovered during the inspection which pertains to the driver of the commercial vehicle.

**DURATION:** The amount of time required to complete a given inspection. It is calculated

using the "start" and "finish" times recorded by the inspector on the inspection document.

**FACILITY TYPE:** The type of facility—*fixed* or *mobile*—at which the inspection was conducted.

**FEDERAL MOTOR CARRIER SAFETY REGULATIONS (FMCSR):** Regulations governing the safe operation of commercial vehicles engaged in interstate commerce. The FMCSR are contained in the *Code of Federal Regulations*, Title 49, Subtitle B, Chapter III. States participating in MCSAP have adopted their own State-level versions of the FMCSR.

**FIXED FACILITY:** A State commercial vehicle "scale" facility or other permanent site used for the conduct of inspections.

**FLEET SIZE:** The total number of power units (truck-tractors and straight trucks) owned or operated by a given motor carrier.

**FOR-HIRE CARRIER:** A commercial motor carrier whose primary business activity is the transportation of property by motor vehicle for compensation.

**FOR-HIRE CARRIER—AUTHORIZED:** A for-hire carrier subject to economic regulation by the Interstate Commerce Commission.

**FOR-HIRE CARRIER—EXEMPT:** A for hire-carrier *not* subject to economic regulation by the Interstate Commerce Commission.

**FULL INSPECTION:** The most comprehensive and thorough of the inspection types, it involves extensive vehicle checks—including under-the-vehicle measurement of brake performance—and examination of hours-of-service logs. This inspection type is a *Level I* inspection; it is also sometimes referred to as the *North American Standard (NAS)*.

**HAZARDOUS MATERIALS:** Materials, substances, or wastes which, due to their compositional nature, may be toxic, harmful, or fatal if accidentally exposed to humans, animals, or the environment.

**HAZARDOUS MATERIALS REGULATIONS (HMR):** Federal regulations governing the commercial transportation of hazardous materials. The HMR are contained in the *Code of Federal Regulations*, Title 49, Subtitle B, Chapter I.

**HAZARDOUS MATERIALS VIOLATION:** A violation discovered during the inspection which pertains to the transportation of hazardous materials.

**INSPECTION:** The systematic examination of a commercial motor vehicle and its driver to determine their overall safety fitness.

**INSPECTION LEVEL:** Refers to the inspection methodology employed in the examination of a given vehicle and driver. Five inspection levels are referenced in this report: *Full, Walk-Around, Driver-Only, Terminal*, and *Special*.

**INTERSTATE CARRIER:** A carrier who sometimes or always operates in interstate or foreign commerce. For the purposes of this report, "interstate carrier" is defined also to include carriers of hazardous materials who operate in interstate, foreign, or intrastate commerce.

**INTERSTATE MOTOR CARRIER INSPECTION DATABASE:** A database on the OMC mainframe computer containing records of inspections of interstate carriers. State inspection records are uploaded to the mainframe using SAFETYNET.

**INTRASTATE CARRIER:** A carrier who operates solely in intrastate commerce and, for

the purposes of this report, never transports hazardous materials.

**LOCATION:** The U.S. State or Territory, Canadian Province, or Mexican State in which a specific inspection was conducted.

**MOBILE INSPECTION FACILITY:** A non-permanent inspection facility. Mobile facilities can be moved from one location to another, as conditions warrant. Sometimes called a "roadside" facility.

**MOTOR CARRIER CENSUS DATABASE:** A database on the OMC mainframe containing information identifying interstate commercial carriers. A unique USDOT Number is assigned to each carrier in the database and is used to link records in the Inspection Database to the appropriate carriers in the Census Database.

**MOTOR CARRIER MANAGEMENT INFORMATION SYSTEM (MCMIS):** The computerized system, operated by the OMC, containing comprehensive safety data on interstate commercial carriers. Two parts of MCMIS are the *Interstate Motor Carrier Inspection Database* and the *Motor Carrier Census Database*.

**MOTOR CARRIER SAFETY ASSISTANCE PROGRAM (MCSAP):** A Federal program providing funds to U.S. States and territories for activities in support of commercial motor vehicle safety. To receive MCSAP funds, States must adopt interstate and intrastate regulations which are compatible with the FMCSR and HMR. The OMC is the Federal agency responsible for administering MCSAP.

**OFFICE OF MOTOR CARRIERS (OMC):** The agency within the U.S. Federal Highway Administration responsible for commercial vehicle safety.

**OOS VIOLATION RATE:** The mean number of OOS violations per 100 inspections.

**OUT-OF-SERVICE (OOS) VIOLATION:** A violation of the FMCSR or HMR requiring that a commercial vehicle or driver be taken out of service or moved off the road until the circumstances which caused the violation have been resolved.

**PRIVATE CARRIER:** A commercial motor carrier for which private highway transportation activities are incidental to, and only in furtherance of, its primary business activity.

**SAFETYNET:** A State-based information system used to store and process commercial carrier safety information, including driver-vehicle inspection data. The use of SAFETYNET ensures that data electronically transferred to MCMIS are in a standard format and have successfully passed through a variety of edit checks.

**SINGLE:** A commercial motor vehicle consisting of a truck-tractor and a detachable trailer.

**SPECIAL STUDY:** Ad hoc examination of particular items, usually inspected in support of a particular study or verification/refutation of a specific trend. This inspection type is a *Level IV* inspection.

**STRAIGHT TRUCK:** A commercial motor vehicle in which the power unit and cargo box are non-detachable.

**TERMINAL INSPECTION:** Examination of vehicles at carriers' terminal facilities. Although the inspection methodology employed may vary, a Walk-Around technique is generally used. Terminal inspections normally focus only on the "vehicle" aspects of the inspection process. This inspection type is a *Level V* inspection.

**TRIPLE:** A commercial motor vehicle consist-

ing of a truck-tractor and three detachable trailers.

**TRUCK-TRACTOR:** A self-propelled motor vehicle designed and primarily used to draw other vehicles.

**USDOT NUMBER:** An identification number assigned to all interstate commercial carriers regulated by the OMC. The number is used to track the safety records associated with a given carrier.

**VEHICLE CONFIGURATION:** Arrangement of the individual units—truck-tractors, trailers, etc.—comprising a commercial vehicle.

**VEHICLE MILES OF TRAVEL (VMT):** The total miles accumulated by all the vehicles operated by a given carrier over a specified period of time.

**VEHICLE VIOLATION:** A violation discovered during the inspection which pertains to the commercial vehicle itself.

**VIOLATION:** A violation of the FMCSR or HMR.

**VIOLATION RATE:** The mean number of violations per 100 inspections.

**VIOLATION-TO-OOS VIOLATION RATIO:** The ratio of total violations to total out-of-service violations.

**WALK-AROUND INSPECTION:** Follows most procedures of the Full Inspection, except those actions which can only be accomplished by climbing underneath the vehicle (e.g., to measure brake performance). This inspection type is a *Level II* inspection.

## Common Vehicle Configurations

Tractor



Straight Truck



Tractor-Trailer/Single



Tractor-Trailer/Double



Tractor-Trailer/Triple



Bus











U.S. Department  
of Transportation

**Federal Highway  
Administration**

400 Seventh St., S.W.  
Washington, D.C. 20590

Official Business  
Penalty for Private Use \$300